

BMR 453- ~~series~~	EN/LZT 146 395 ~~R3A-July 2010~~ R1B September
DC/DC ~~converters~~ Converters, Input 36-75 V, Output ~~up to~~	2008
~~60~~ 33 A / ~~396~~ /400 W	© Ericsson AB

Ericsson Internal	Ericsson Internal	Ericsson Internal	2 (2)
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Prepared (also subject responsible if other)			
EAB/FC/P Jakub Brindell	11300152	BMR 911 483/1	Reference
SEC/SEC/S Kevin Zhou	11300152	BMR 911 483/1	Reference
EAB/FC/P	Jakub Brindell	2008-09-08	Rev
EAB/FC/P	Jakub Brindell	2008-08-25	C

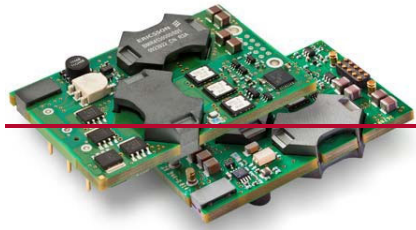
Key Features

- Industry standard Quarter-brick
57.9 x 36.8 x 11.6 mm (2.28 x 1.45 x 0.46 in.)
- High efficiency, typ. 96 % at half load, 12 Vout
- +/- 2% output voltage tolerance band
- 1500 Vdc input to output isolation
- 1.1 million hours MTBF
- Optional baseplate
- ISO 9001/14001 certified supplier
- PMBus Revision 1.1 compliant



Power Management

- ~~Programmable Build-in Active Current Share-~~
~~up to 792 W in parallel configuration~~
- Configurable soft start/stop
- Precision delay and ramp-up
- Voltage sequencing and margining
- Voltage/current/temperature monitoring
- Configurable output voltage
- Power good



- Synchronization
- Voltage track

Safety Approvals



Design for Environment



RoHS
compatible ✓



RoHS
compatible ✓

Meets requirements in high-

● Synchronization
● Voltage track

SE-57003M1

temperature

lead-free soldering processes.



Technical Specification

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Technical Specification 2



Technical Specification 2

BMR 453-series

DC/DC converters Converters, Input 36-75 V, Output up to 60/33 A / 396/400 W

EN/LZT 146 395 R3A July 2010 R1B September 2008

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Ordering Information

Product Program

Product-program	Output
BMR4530002/003	3.3 V / 60 A, 198 W
BMR4530002/004	5 V / 60 A, 300 W
BMR4530000/002	9 V / 33 A, 297 W
BMR4530000/001	12 V / 33 A, 396 W

Product Number

BMR453	R1	R2	R3	R4	/	R5	R6	R7	R8
Mechanical pin-option	x				/				
Mechanical option		x			/				
Hardware-option			x	x	/				
Configuration file					/	x	x	x	x

Optional designation	Description
R1	0 = Standard pin length 5.33 mm 1 = Surface mount option, ^{note 1} 2 = Lead length 3.69 mm (cut) 3 = Lead length 4.57 mm (cut) 4 = Lead length 2.79 mm (cut) 5 = Lead length 2.79 mm stand-off 6.7 mm
R2	0 = Open frame 1 = Baseplate 2 = Baseplate with GND-pin
R3-R4	00 = 8.1-13.2Vout With digital interface 01 = 8.1-13.2Vout Without digital interface 02 = 3-6.7Vout With digital interface 03 = 3-6.7Vout Without digital interface
R5-R6-R7	001 = 12V Standard configuration 002 = 9V Standard configuration 003 = 3.3V Standard configuration 004 = 5V Standard configuration 007 = 9V with positive RC logic configuration 008 = 12V with positive RC logic configuration 009 = 3.3V with positive RC logic configuration 010 = 5V with positive RC logic configuration xxx = Application-Specific Configuration
R8 (optional ^{note 2})	M = Master Configuration S = Slave Configuration
Packaging	20 converters/tray/box PE foam dissipative

Example: Product number BMR4532000/002 equals an Through hole mount lead length 3.69 mm (cut), open frame, digital interface with 9 V standard configuration variant.

Note 1: Surface mount option available for 3-6.7Vout and 8.1-13.2Vout open frame version. Can not be combined with base plate option.

Note 2: Master/Slave option only available on 8.1-13.2Vout hardware.

For application specific configurations contact your local Ericsson Power Modules sales representative.

General Information

Reliability

The Mean Time Between Failure (MTBF) is calculated at full output power and an operating ambient temperature (T_A) of +40°C, which is a typical condition in Information and Communication Technology (ICT) equipment. Different methods could be used to calculate the predicted MTBF and failure rate which may give different results.

Ericsson Power Modules currently uses Telcordia SR332. Predicted MTBF for the series is:

— 1.1 million hours according to Telcordia SR332, issue 1, Black box technique.

Telcordia SR332 is a commonly used standard method intended for reliability calculations in ICT equipment. The parts count procedure used in this method was originally modelled on the methods from MIL-HDBK-217F, Reliability Predictions of Electronic Equipment. It assumes that no reliability data is available on the actual units and devices for which the predictions are to be made, i.e. all predictions are based on generic reliability parameters.

Compatibility with RoHS requirements

The products are compatible with the relevant clauses and requirements of the RoHS directive 2002/95/EC and have a maximum concentration value of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, PBB and PBDE and of 0.01% by weight in homogeneous materials for cadmium.

Exemptions in the RoHS directive utilized in Ericsson Power Modules products include:

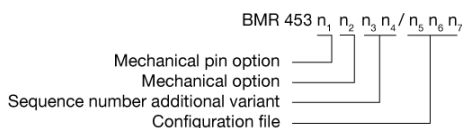
- Lead in high melting temperature type solder (used to solder the die in semiconductor packages)
- Lead in glass of electronics components and in electronic ceramic parts (e.g. fill material in chip resistors)
- Lead as an alloying element in copper alloy containing up to 4% lead by weight (used in connection pins made of Brass)

Quality Statement

The products are designed and manufactured in an industrial environment where quality systems and methods like ISO 9000, 6σ (sigma), and SPC are intensively in use to boost the continuous improvements strategy. Infant mortality or early failures in the products are screened out and they are subjected to an ATE-based final test. Conservative design rules, design reviews and product qualifications, plus the high competence of an engaged work force, contribute to the high quality of our products.

General Information

Ordering Information



Number	Description
BMR453	Default
n_1	0 = Standard pin length 5.33 mm 2 = Lead length 3.69 mm (cut) 3 = Lead length 4.57 mm (cut) 4 = Lead length 2.79 mm (cut) 5 = Lead length 2.79 mm stand off 6.7mm
n_2	0 = Open frame 1 = Baseplate
n_3 n_4	00 = With digital interface 01 = Without digital interface
n_5 n_6 n_7	001 = 12V Default configuration variant 002 = 9V Default configuration variant

As an example an open frame, 3.69 mm pin length with digital interface with configuration variant 002 would be BMR4532000/002.

Reliability

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Power Modules products include:

- Lead in high melting temperature type solder (used to solder the die in semiconductor packages)
- Lead in glass of electronics components and in electronic ceramic parts (e.g. fill material in chip resistors)
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Warranty

Warranty period and conditions are defined in Ericsson AB's General Terms and Conditions of Sale. Ericsson AB does not make any other warranties, expressed or implied including any warranty of merchantability, effects of product configurations made by customers or fitness for a particular purpose.

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BMR 453-series	EN/LZT 146 395 R3A July 2010R1B September 2008
DC/DC convertersConverters, Input 36-75 V, Output up to 6033 A/396/400 W	© Ericsson AB

Warranty

Warranty period and conditions are defined in Ericsson Power Modules General Terms and Conditions of Sale.

Limitation of Liability

Ericsson Power Modules does not make any other warranties, expressed or implied, of merchantability or fitness for a particular purpose (including, but not limited to, use in life support applications, where malfunctions of product can cause injury to a person's health or life).

Safety Specification

General information

Ericsson Power Modules DC/DC converters and DC/DC regulators are designed in accordance with safety standards IEC/EN/UL60950. *Safety of Information Technology Equipment.*

IEC/EN/UL60950 contains requirements to prevent injury or damage due to the following hazards:

- Electrical shock
- Energy hazards
- Fire
- Mechanical and heat hazards
- Radiation hazards
- Chemical hazards

On-board DC-DC converters and DC/DC regulators are defined as component power supplies. As components they cannot fully comply with the provisions of any Safety requirements without "Conditions of Acceptability". Clearance between conductors and between conductive parts of the component power supply and conductors on the board in the final product must meet the applicable Safety requirements. Certain conditions of acceptability apply for component power supplies with limited stand-off (see Mechanical Information for further information). It is the responsibility of the installer to ensure that the final product housing these components complies with the requirements of all applicable Safety standards and Directives for the final product.

Component power supplies for general use should comply with the requirements in IEC60950, EN60950 and UL60950 "Safety of information technology equipment". There are other more product related standards, e.g. IEEE802.3af "Ethernet LAN/MAN Data terminal equipment power", and ETS300132-2 "Power supply interface at the input to telecommunications equipment; part 2: DC", but all of these standards are based on IEC/EN/UL60950 with regards to safety.

Ericsson Power Modules DC/DC converters and DC/DC regulators are UL60950 recognized and certified in accordance with EN60950.

The flammability rating for all construction parts of the products meets requirements for V-0 class material according to IEC 60695-11-10.

The products should be installed in the end-use equipment, in accordance with the requirements of the ultimate application. Normally the output of the DC/DC converter is considered as SELV (Safety Extra Low Voltage) and the input source must be isolated by minimum Double or Reinforced Insulation from the primary circuit (AC mains) in accordance with IEC/EN/UL60950.

Isolated DC/DC converters

It is recommended that a slow blow fuse with a rating twice the maximum input current per selected product be used at the input of each DC/DC converter. If an input filter is used in the circuit the fuse should be placed in front of the input filter.

In the rare event of a component problem in the input filter or in the DC/DC converter that imposes a short circuit on the input source, this fuse will provide the following functions:

- Isolate the faulty DC/DC converter from the input power source so as not to affect the operation of other parts of the system.
- Protect the distribution wiring from excessive current and power loss thus preventing hazardous overheating.

The galvanic isolation is verified in an electric strength test. The test voltage (V_{iso}) between input and output is 1500 Vdc or 2250 Vdc for 60 seconds (refer to Absolute maximum ratings). Leakage current is less than 1 μ A at nominal input voltage.

24 V DC systems

The input voltage to the DC/DC converter is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

48 and 60 V DC systems

If the input voltage to the DC/DC converter is 75 Vdc or less, then the output remains SELV (Safety Extra Low Voltage) under normal and abnormal operating conditions.

Single fault testing in the input power supply circuit should be performed with the DC/DC converter connected to demonstrate that the input voltage does not exceed 75 Vdc.

If the input power source circuit is a DC power system, the source may be treated as a TNV2 circuit and testing has demonstrated compliance with SELV limits and isolation requirements equivalent to Basic Insulation in accordance with IEC/EN/UL60950.

Non-isolated DC/DC regulators

The input voltage to the DC/DC regulator is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

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- Energy hazards
- Fire
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- Radiation hazards
- Chemical hazards

On-board DC/DC converters and DC/DC regulators are defined as component power supplies. As components they cannot fully comply with the provisions of any Safety requirements without "Conditions of Acceptability". Clearance between conductors and between conductive parts of the component power supply and conductors on the board in the final product must meet the applicable Safety requirements. Certain conditions of acceptability apply for component power supplies with limited stand-off (see Mechanical Information for further information). It is the responsibility of the installer to ensure that the final product housing these components complies with the requirements of all applicable Safety standards and Directives for the final product.

Component power supplies for general use should comply with the requirements in IEC60950, EN60950 and UL60950 "Safety of information technology equipment".

There are other more product related standards, e.g. IEEE802.3af "Ethernet LAN/MAN Data terminal equipment power", and ETS300132-2 "Power supply interface at the input to telecommunications equipment; part 2: DC", but all of these standards are based on IEC/EN/UL60950 with regards to safety.

Ericsson Power Modules DC/DC converters and DC/DC regulators are UL60950 recognized and certified in accordance with EN60950.

The flammability rating for all construction parts of the products meets requirements for V-0 class material according to IEC 60695-11-10.

The products should be installed in the end-use equipment, in accordance with the requirements of the ultimate application. Normally the output of the DC/DC converter is considered as SELV (Safety Extra Low Voltage) and the input source must be isolated by minimum Double or Reinforced Insulation from the primary circuit (AC mains) in accordance with IEC/EN/UL60950.

Isolated DC/DC converters

It is recommended that a slow blow fuse with a rating twice the maximum input current per selected product be used at the input of each DC/DC converter. If an input filter is used in the circuit the fuse should be placed in front of the input filter.

In the rare event of a component problem in the input filter or in the DC/DC converter that imposes a short circuit on the input source, this fuse will provide the following functions:

- Isolate the faulty DC/DC converter from the input power source so as not to affect the operation of other parts of the system.
- Protect the distribution wiring from excessive current and power loss thus preventing hazardous overheating.

The galvanic isolation is verified in an electric strength test. The test voltage (V_{iso}) between input and output is 1500 Vdc or 2250 Vdc for 60 seconds (refer to Absolute maximum ratings). Leakage current is less than 1 μ A at nominal input voltage.

24 V DC systems

The input voltage to the DC/DC converter is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.

48 and 60 V DC systems

If the input voltage to the DC/DC converter is 75 Vdc or less, then the output remains SELV (Safety Extra Low Voltage) under normal and abnormal operating conditions.

Single fault testing in the input power supply circuit should



Ericsson Internal Technical Specification 4
PRODUCT SPECIFICATION 4 (5)

BMR 453 series		No.	EN/LZT 146 395 R3A July 2010 R1B September 2011
DC/DC converters		1/1301-BMR 453	1/1301-BMR 453
Converters, Input 36-75 V, Output up to		Re Ericsson AB	Re Ericsson AB
60/33 A / 396/400 W		MICHEBO	2010-07-02
SEC/S Kevin Zhou		© Ericsson AB	

be performed with the DC/DC converter connected to demonstrate that the input voltage does not exceed 75 Vdc.

If the input power source circuit is a DC power system, the source may be treated as a TNV2 circuit and testing has demonstrated compliance with SELV limits and isolation requirements equivalent to Basic Insulation in accordance with IEC/EN/UL60950.

Non-isolated DC/DC regulators

The input voltage to the DC/DC regulator is SELV (Safety Extra Low Voltage) and the output remains SELV under normal and abnormal operating conditions.



No.

~~2/1301-BMR 453-1101~~
~~ENRZT 146 395 R3A July 2010~~

Checked	Date	Rev	Reference
5 V, Output up to 60 A / 396 W (MILCJMA)	2019-06-30	53	E

Checkin	Date	Rev	Reference
© Ericsson AB (MICJMAL)	2018-06-18	A	

Characteristics		min	typ	max	Unit
$T_{\text{inf}}T_{\text{sup}}$	Operating Temperature (see Thermal Consideration section)	-40		+125	°C
T_{S}	Storage temperature	-55		+125	°C
V_{I}	Input voltage	-0.5		±80	V
V_{iso}	Isolation voltage (input to output test voltage), see note 1			1500	Vdc
V_{T}	Input voltage transient (Tp 100 ms)			100	V
V_{RC}	Remote Control pin voltage	-0.3		18	V
V Logic	SALERT, CTRL, SYNC, SCL, SDA, SA(0,1)	-0.3		3.6	V

Note 1: Isolation voltage (input/output to base-plate) max 750Vdc.



Technical Specification 6

Ericsson Internal
PRODUCT SPECIFICATION 2 (15)

Prepared (also subject responsible if other)	No.	5N/1ZT.146.395 R3A July 2010 R1B September 2008
~~BMR 453 series~~	~~2/1301-BMR 453~~	~~Ericsson AB~~
~~DC/DC converters~~	~~Converters, Input 36-75 V, Output up to 600 mA, 0-200 mV~~	~~Reference~~
~~EABIFJBiGKF (Natalie Johansson)~~	~~(MICJMAL)~~	~~Ericsson AB~~
~~2010-06-30~~	~~2010-06-30~~	~~Reference~~
~~EABIFJBiGKF (Natalie Johansson)~~	~~(MICJMAL)~~	~~2008-06-18~~

Functional Description

$T_{\text{st}} = -40$ to $+90^{\circ}\text{C}$, $V_i = 36$ to 75 V, sense pins connected to output pins unless otherwise specified under Conditions.

Typical values given at: $T_{\text{st}} = +25^{\circ}\text{C}$, $V_i = 53$ V, max I_o , unless otherwise specified under Conditions

Configuration File: 190 10-CDA 102 935/001 rev BE

Characteristics	Conditions	min	typ	max	Unit
PMBus monitoring accuracy					
VIN_READ_0x88h	Input voltage Accuracy vs V_i	-3	+0.4	3	%
VOUT_READ_0x8Bh	Output voltage Accuracy vs V_o	$V_i = 53$ V	-1.0	-0.3	1.0
IOUT_READ_0x8Ch	Output current Accuracy vs I_o	$V_i = 53$ V, 50-100% of max I_o	-6	-1.0	6
IOUT_READ_0x8Ch	Output current Accuracy vs I_o	$V_i = 53$ V, 10% of max I_o	-0.720	-	0.720
TEMP_READ	Temperature	-5		5	$^{\circ}\text{C}$
Fault Protection Characteristics					
Input Under Voltage Lockout, _UVLO	Factory default	-	33	-	V
	Setpoint accuracy	-3	-	3	%
	Hysteresis	Factory default	1.8	-	V
		Configurable via PMBus of threshold range, Note 1	0	-	V
(Output voltage) Over/Under Voltage Protection, OVP/UVF	Delay	-	200	-	μs
	VOUT_UV_FAULT_LIMIT	Factory default	0	-	V
		Configurable via PMBus, Note 1	0	16	V
	VOUT_OV_FAULT_LIMIT	Factory default	-	15.6	-
Over Current Protection, OCP		Configurable via PMBus, Note 1	V_{OUT}	16	V
	fault response time	-	200	-	μs
	Setpoint accuracy	I_o	-6	6	%
	IOUT_OC_FAULT_LIMIT	Factory default	-	3839	A
Over Temperature Protection, OTP		Configurable via PMBus, Note 1	0	100	
	fault response time	-	200	-	μs
	OTP_FAULT_LIMIT	Factory default	-	135	-
		Configurable via PMBus, Note 1	-50	135	$^{\circ}\text{C}$
Logic Input/Output Characteristics	OTP hysteresis	Factory default	10	-	
		Configurable via PMBus, Note 1	0	165	
	fault response time	-	200	-	μs
Logic input low threshold (V_{IL})	CTRL_CS, SA0, SA1, PG_SYNC, SCL, SDA,	-	-	0.8	V
Logic input high threshold (V_{IH})		2.0	-	3.45	V
Logic output low threshold (V_{OL})	CTRL_CS, PG_SYNC, SALERT, SCL, SDA $I_{OL} = 5$ mA	-	-	0.4	V
Logic output high threshold (V_{OH})	CTRL_CS, PG_SYNC, SALERT, SCL, SDA $I_{OH} = -5$ mA	2.8	-	-	V
Setup time, SMBus	Data change from high to low	400250	-		ns
	Data change from low to high	250			ns
Hold time, SMBus	Data change from high to low	300			ns
	Data change from low to high	300			ns

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Note 1:- See Operating Information section.



Technical Specification 7



Technical Specification

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BMR 453-series		Ericsson Internal	EN/LZT 146 395 R3A July 2010 R1B September 2010	
DC/DC converters		PRODUCT SPECIFICATION		
Converters, Input 36-75 V, Output up to 3.3 V, 60A / 306/400 W		© Ericsson AB		
6000A / 306/400 W		2/1301-BMR 453-Uen		
Approved	Checked	Date	Rev Reference	
EAB/FJB/GMF (Natalie Johansson)	(MICJMAL)	2010-06-30	E	
		© Ericsson AB		

3.3V, 60A / 198W 9.0V, 33A / 300W Electrical Specification**BMR 453**

$T_{\text{ref}} T_{\text{ref}} = -40$ to $+90^{\circ}\text{C}$, $V_{\text{I}} = 36$ to 75 V , sense pins connected to output pins unless otherwise specified under Conditions.
Typical values given at: $T_{\text{ref}} T_{\text{ref}} = +25^{\circ}\text{C}$, $V_{\text{I}} = 53\text{ V}$, max I_{O} , unless otherwise specified under Conditions.
Additional $C_{\text{out}} = 0.1\text{ mF}$, Configuration File: 190 10-CDA 102 935/003/002 rev B

Characteristics		Conditions	min	typ	max	Unit
V _I	Input-voltage-range		36		75	V
V _{off}	Turn-off input-voltage	Decreasing input-voltage	32	33	34	V
V _{on}	Turn-on input-voltage	Increasing input-voltage	34	35	36	V
C _i	Internal input-capacitance			40		μF
P _O	Output-power		0		198	W
η	Efficiency	50-%-of-max-I _O		94.7		%
		max-I _O		93.3		
		50-%-of-max-I _O , V _I =48-V		94.9		
		max-I _O , V _I =48-V		93.3		
P _d	Power-Dissipation	max-I _O		14.1	20.8	W
P _i	Input-idling-power	I _O =0-A, V _I =53-V		1.7		W
P _{sc}	Input-standby-power	V _I =53-V (turned-off-with-RC)		123		mW
f _s	Default-switching-frequency	0-100-%-of-max-I _O see-Note-1	171	180	189	kHz

V_{OI}	Output voltage initial setting and accuracy	$T_{\text{ref}} = +25^{\circ}\text{C}$, $V_{\text{I}} = 53\text{ V}$, $I_{\text{O}} = 60\text{ A}$	3.26	3.3	3.36	V
V_{O}	Output adjust range	See operating information	3.0		6.7	V
	Output voltage tolerance band	0-100% of max I_{O}	3.22		3.38	V
	Line regulation	max I_{O}		4	16	mV
	Load regulation	$V_{\text{I}} = 53\text{ V}$, 1-100% of max I_{O}		4	12	mV
V_{r}	Load transient voltage deviation	$V_{\text{I}} = 53\text{ V}$, Load step 25-75-25 % of max I_{O} , $di/dt = 1\text{ A}/\mu\text{s}$, see Note 2		± 0.2		V
t_{r}	Load transient recovery time			250		μs
t_{r}	Ramp-up time (from 10-90 % of V_{O})	10-100% of max I_{O} , $T_{\text{ref}} = 25^{\circ}\text{C}$, $V_{\text{I}} = 53\text{ V}$ see Note 3		8		ms
t_{r}	Start-up time (from V_{I} connection to 90% of V_{O})			140		ms
t_{f}	Vin shutdown fall time (from V_{I} off to 10% of V_{O})	max I_{O}		0.2		ms
		$I_{\text{O}} = 0\text{ A}$		4.5		s
t_{RC}	RC start-up time	max I_{O}		52		ms
	RC shutdown fall time (from RC off to 10% of V_{O})	max I_{O}		3		ms
		$I_{\text{O}} = 0\text{ A}$		4.5		s
I_{O}	Output current		0		60	A
I_{lim}	Current limit threshold	$V_{\text{O}} = 3.0\text{ V}$, $T_{\text{ref}} < \text{max } T_{\text{ref}}$	61	66	82	A
I_{sc}	Short circuit current	$T_{\text{ref}} = 25^{\circ}\text{C}$, $V_{\text{O}} < 0.2\text{ V}$, see Note 4		11		A
C_{out}	Recommended Capacitive Load	$T_{\text{ref}} = 25^{\circ}\text{C}$, see Note 5	0.1	6	10	mF
V_{Orr}	Output ripple & noise	See ripple & noise section, max I_{O} , V_{OI}		30	100	mVp-p
OVP	Over-voltage protection	$T_{\text{ref}} = +25^{\circ}\text{C}$, $V_{\text{I}} = 53\text{ V}$, 10-100% of max I_{O} see Note 6		4.6		V

Note 1: Frequency may be adjusted via PMBus, see Operating Information section.
Note 2: $C_{\text{out}} = 6\text{ mF}$ used at load transient test.
Note 3: Start up and Ramp up time can be increased via PMBus, see Operation Information section.
Note 4: RMS current in hiccup mode.
Note 5: Low ESR-value.

Note 6: OVP level can be adjusted via PMBus, see Operation Information.



BMR 453 series

DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

LAB: JB/GMP (Natale Johansson)

© Ericsson AB

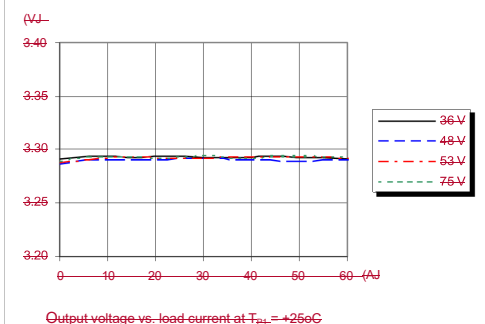
EN/LZT 146-395-R3A-July 2010

E

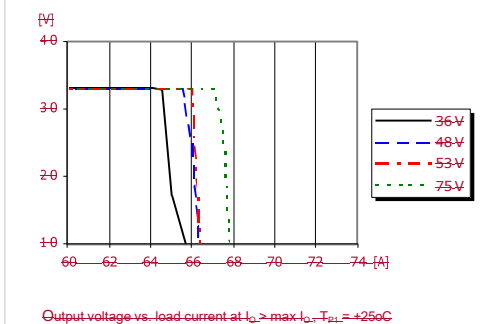
3.3V, 60A / 198W Electrical Specification

BMR 453-0002/003

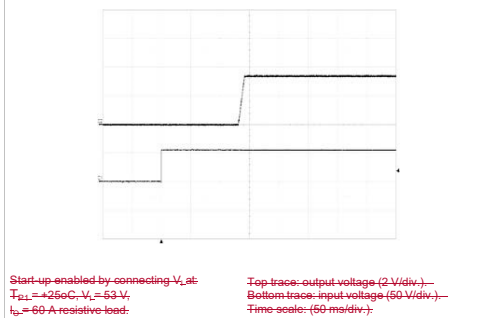
Output Characteristics



Current Limit Characteristics



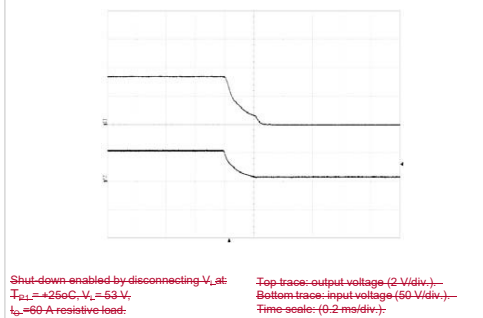
Start-up



Start-up enabled by connecting V_{in} at:
 $T_{PL} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_O = 60\text{ A}$ resistive load.

Top trace: output voltage (2 V/div).
Bottom trace: input voltage (50 V/div).
Time scale: (50 ms/div).

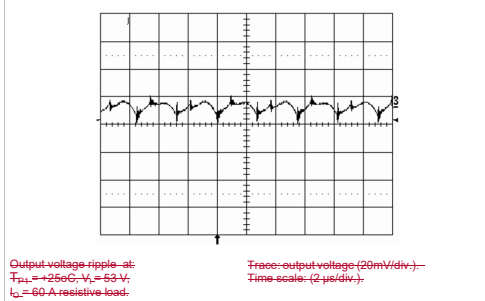
Shut-down



Shut-down enabled by disconnecting V_{in} at:
 $T_{PL} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_O = 60\text{ A}$ resistive load.

Top trace: output voltage (2 V/div).
Bottom trace: input voltage (50 V/div).
Time scale: (0.2 ms/div).

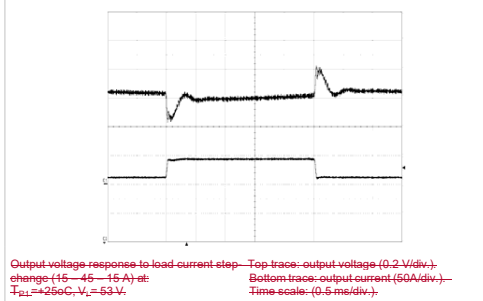
Output Ripple & Noise



Output voltage ripple at:
 $T_{PL} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_O = 60\text{ A}$ resistive load.

Trace: output voltage (20 mV/div).
Time scale: (2 μs/div).

Output Load Transient Response



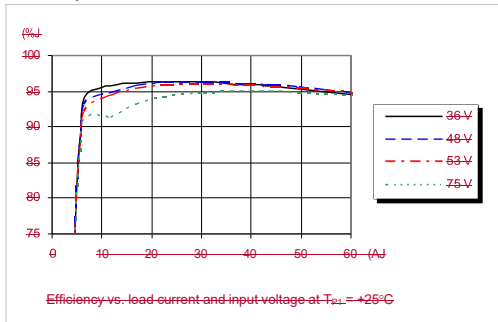
Output voltage response to load current step—
change (15—45—15 A) at:
 $T_{PL} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$.



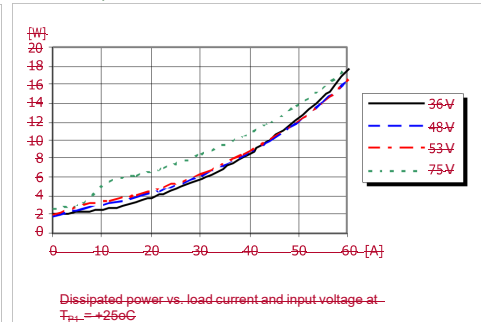
Prepared (also subject responsible if other)	No.	2/1301-BMR 453 Uen	Rev	Reference
Approved	Checked	Date	Rev	Reference
EA01-JB/GMP (Natale Johansson)	(nil)	2010-08-30	E	
© Ericsson AB				

5.0V, 60A / 300W Electrical Specification BMR 453-0002/004

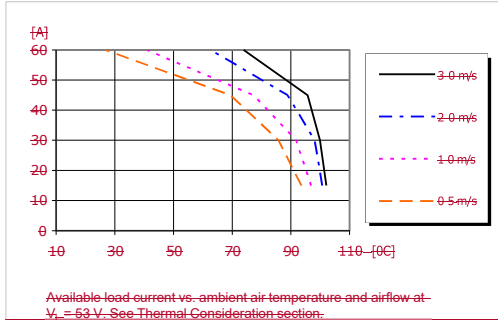
Efficiency



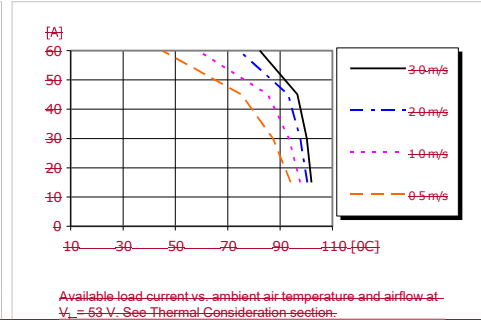
Power Dissipation



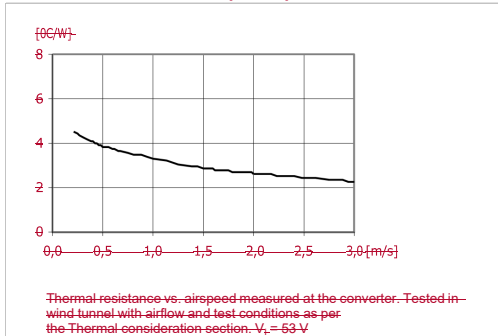
Output Current Derating, open frame



Output Current Derating, base-plate option



Thermal Resistance, base-plate option





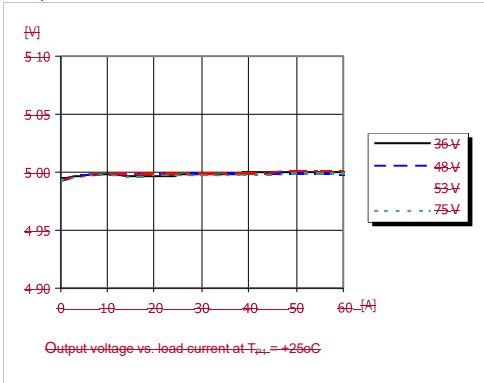
BMR 453 series
DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

EN/LZT-146-395-R3A-July-2010
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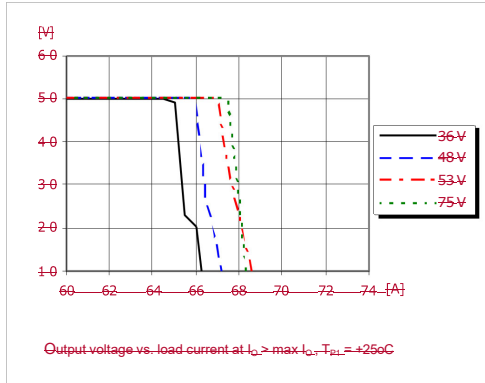
5.0V, 60A / 300W Electrical Specification

BMR 453-0002/004

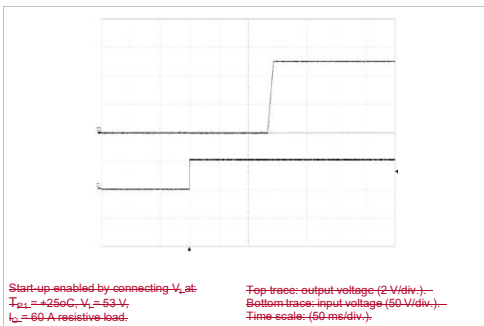
Output Characteristics



Current Limit Characteristics

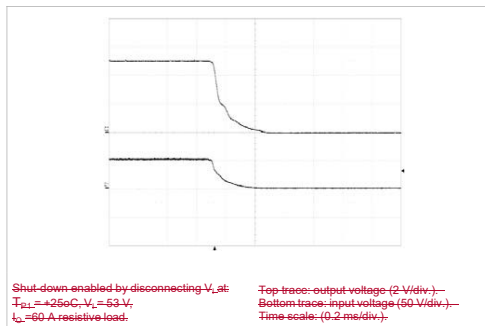


Start up



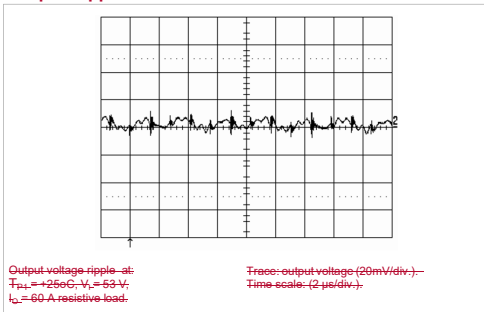
Start-up enabled by connecting V_{in} at:
 $T_{amb} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_o = 60\text{ A}$ resistive load.
Top trace: output voltage (2 V/div.)—
Bottom trace: input voltage (50 V/div.)—
Time scale: (50 ms/div.)

Shut down



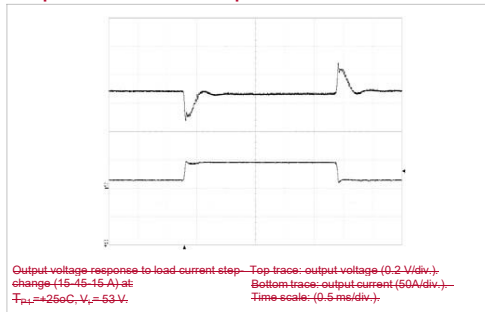
Shut-down enabled by disconnecting V_{in} at:
 $T_{amb} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_o = 60\text{ A}$ resistive load.
Top trace: output voltage (2 V/div.)—
Bottom trace: input voltage (50 V/div.)—
Time scale: (0.2 ms/div.)

Output Ripple & Noise

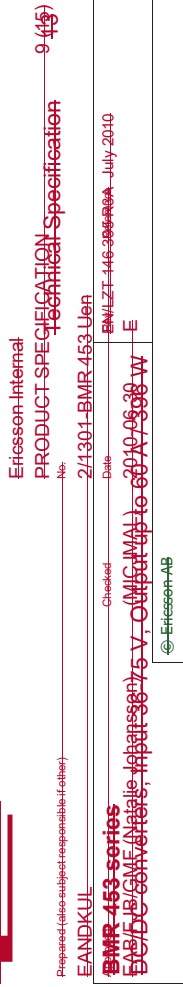


Output voltage ripple at:
 $T_{amb} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$,
 $I_o = 60\text{ A}$ resistive load.
Trace: output voltage (20 mV/div.)—
Time scale: (2 µs/div.)

Output Load Transient Response



Output voltage response to load current step—Top trace: output voltage (0.2 V/div.)—
change (15-45-15 A) at:
 $T_{amb} = +25^{\circ}\text{C}$, $V_{in} = 53\text{ V}$.
Bottom trace: output current (50 A/div.)—
Time scale: (0.5 ms/div.)



~~BMR 453 0000/002~~

$T_{SL} = -40$ to $+90^{\circ}\text{C}$, $V_L = 36$ to 75 V , sense pins connected to output pins unless otherwise specified under Conditions—
Typical values given at: $T_{SL} = +25^{\circ}\text{C}$, $V_L = 53\text{ V}$, $\text{max. } I_{OL}$ —unless otherwise specified under Conditions;
Additional $C_{ML} = 0.1\text{ mF}$, Configuration File: 190-10-CDA-102-935/002 rev D

Characteristics		Conditions	min	typ	max	Unit
V_i	Input voltage range		36		75	V
V_{off}	Turn-off input voltage	Decreasing input voltage	32	33	34	V
V_{on}	Turn-on input voltage	Increasing input voltage	34	35	36	V
C_i	Internal input capacitance			18		pF
P_o	Output power		0		297	W
		50 % of max I_o		96		
η	Efficiency	max I_o		95		%
		50 % of max I_o , $V_i = 48\text{ V}$		96		
		max I_o , $V_i = 48\text{ V}$		95		
P_d	Power Dissipation	max I_o		45.5 <u>16.0</u>	24.7	W
P_{li}	Input idling power	$I_o = 0\text{ A}$, $V_i = 53\text{ V}$		2.1		W
P_{RC}	Input standby power	$V_i = 53\text{ V}$ (turned off with RC)				
f_s	Default switching frequency	0-100 % of max I_o <u>see Note 4</u>	433	140		mW
					44	Deleted Cells

V _o	Output voltage initial setting and accuracy	$T_{FLL, I_{ref}} = +25^{\circ}\text{C}$, $V_i = 53\text{ V}$, $I_o = 47.33\text{ A}$	8.90	9.0	9.10	V
	Output adjust range	See operating information	8.1	13.25	13.25	V
V _o	Output voltage tolerance band	9.10-100% of max I _o	8.82	9.18	9.18	V
	Line regulation (during voltage)	max I _o = 0 A	8.82	45	509.18	mV/V
V _e	Load line regulation	V _i = 53 V, 1-100% of max I _o	40.20	85.50	85.50	mV
	Load transient voltage deviation equation	V _i = 53 V, Load step 25-75-25-1% 100% of max I _o , dI/dt = 1 A/μs, see Note 2	±0.3	VZ	Inserted Cells	
V _r , V _{r1}	Load transient recovery time, voltage deviation	V _i = 53 V, Load step 25-75-25% of max I _o , dI/dt = 1 A/μs, C _o = 3.3 mF, see Note 1	259.0.3	Inserted Cells		μs/V
t _{tr}	Ramp-up, load transient recovery time (from 10-90% of V _o)	10-100% of max I _o , T _{FLL} = 25°C, V _i = 53 V, see Note 3	8.250	Inserted Cells		ms/μs
t _{tr}	Start/Ramp-up time (from V _i connection to 10-90% of V _o)	10-100% of max I _o , T _{FLL} = 25°C, V _i = 53 V	140	Inserted Cells		ms
t _{tr}	Vin shutdown fall/Start-up time (from V _i off-connection to 10-90% of V _o)	max I _o = 0 A	9.4	140	Inserted Cells	ms
t _{tr}	Vin shutdown fall time (from V _i off to 10% of V _o)	max I _o = 0 A	80.4	Inserted Cells		ms
t _{tr}	RC start-up time	max I _o = 0 A	53.7	Inserted Cells		ms
t _{tr}	RC shutdown fall/Start-up time (from RC off to 10% of V _o)	max I _o	3.253	ms		ms
t _{tr}	RC shutdown fall time (from RC off to 10% of V _o)	max I _o = 0 A	83.2	ms		ms
I _o	Output current	I _o = 0 A	340	Deleted Cells		
I _{lim} , I _o	Current limit threshold/Output current	V _o = 8-14 V, T _{FLL} < max T _{FLL}	38	Deleted Cells		
I _{lim} , I _o	Short-circuit current/Current limit threshold	T _{FLL} = 25°C, V _o < 0.2 V, see Note 4, V _o = 8-14 V, T _{FLL} < max T _{FLL}	634	Deleted Cells		
G _{sw} , I _{sc}	Recommended Capacitive Load/Short circuit current	T _{FLL, I_{ref}} = 25°C, V _o < 0.2 V, see Note 5, T _{FLL} = 25°C, V _o < 0.2 V, see Note 6	0.419	Deleted Cells		
V _{osc}	Output ripple & noise	See ripple & noise section, max I _o , V _o	Page 23	Deleted Cells		
OVP	Over voltage protection	T _{FLL, I_{ref}} = +25°C, V _i = 53 V, 10-100% of	15.6	Deleted Cells		

		max I_{O-} ~~see Note 6~~		
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Note 1: ~~Frequency may be adjusted via PMBus, see Operation Information~~ Output filter according to Ripple & Noise section. Note 2: ~~C_{out} = 3.3mF used at load transient test.~~

~~Note 3: Start-up and Ramp-up time can be increased via PMBus, see Operation Information section.~~ Note 4: RMS current in hiccup mode.

~~Note 5: Low ESR value.~~

~~Note 6: OVP level can be adjusted via PMBus, see Operation Information.~~



Technical Specification	14
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Technical Specification

7

BMR 453-series

DC/DC converters, Input 36-75 V, Output up to 33A, 300/400 W

5000xxx/002

EAB/FJB/GMF (Natalie Johansson)

(MICJMAL)

2010-06-30

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Ericsson Internal

PRODUCT SPECIFICATION

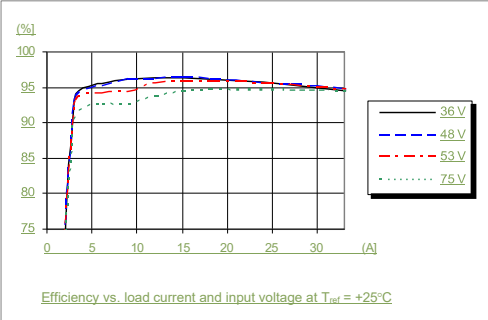
EWL ZT 116-395 R3A July 2010 R1B September 2008

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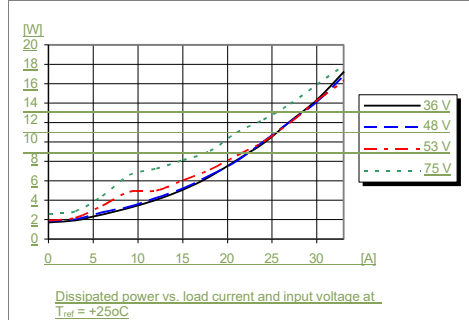
9.0V, 33A / 297W/300W Electrical Specification

BMR 453

Efficiency



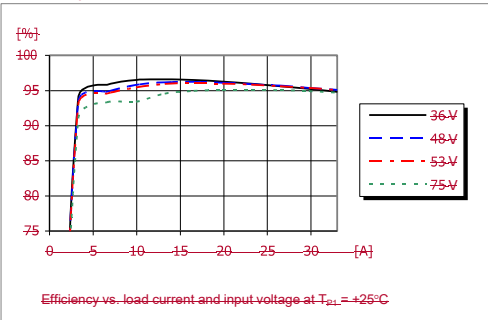
Power Dissipation



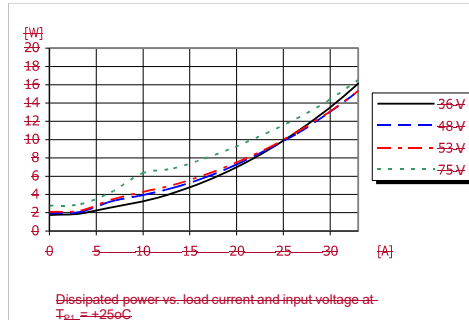
Output Current Derating, open frame

Output Current Derating, base plate option

Efficiency

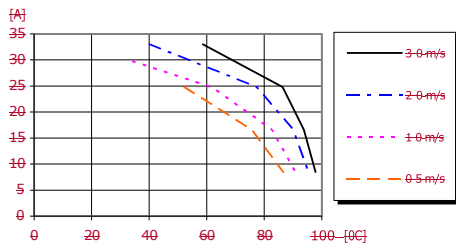


Power Dissipation

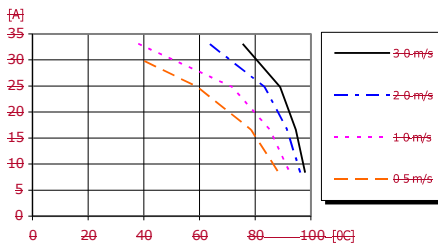


Output Current Derating, open frame

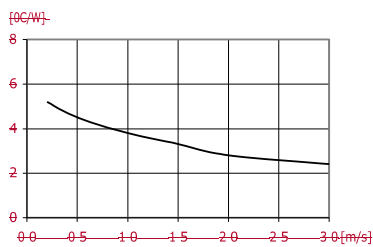
Output Current Derating, base plate option



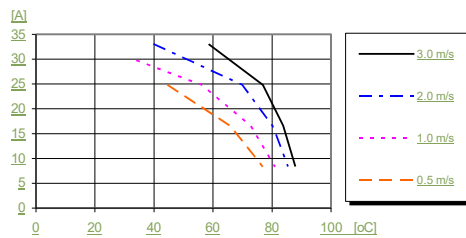
Available load current vs. ambient air temperature and airflow at $V_L = 53$ V. See Thermal Consideration section.



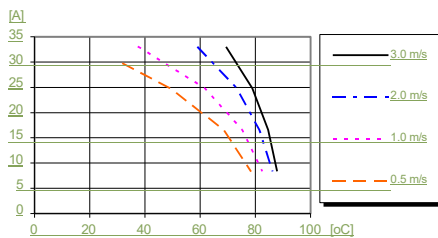
Available load current vs. ambient air temperature and airflow at $V_L = 53$ V. See Thermal Consideration section.



Thermal resistance vs. airspeed measured at the converter. Tested in wind tunnel with airflow and test conditions as per the Thermal consideration section. $V_L = 53$ V

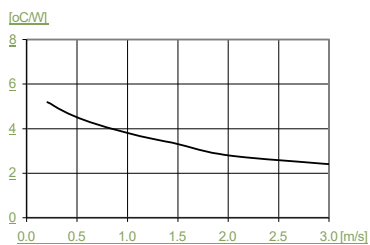


Available load current vs. ambient air temperature and airflow at $V_L = 53$ V. See Thermal Consideration section.



Available load current vs. ambient air temperature and airflow at $V_L = 53$ V. See Thermal Consideration section.

Thermal Resistance, base plate option



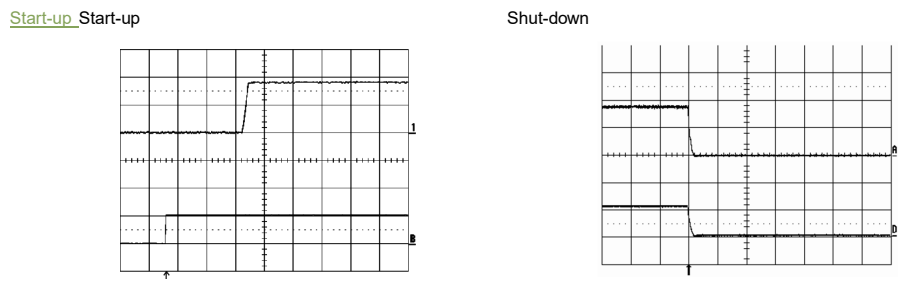
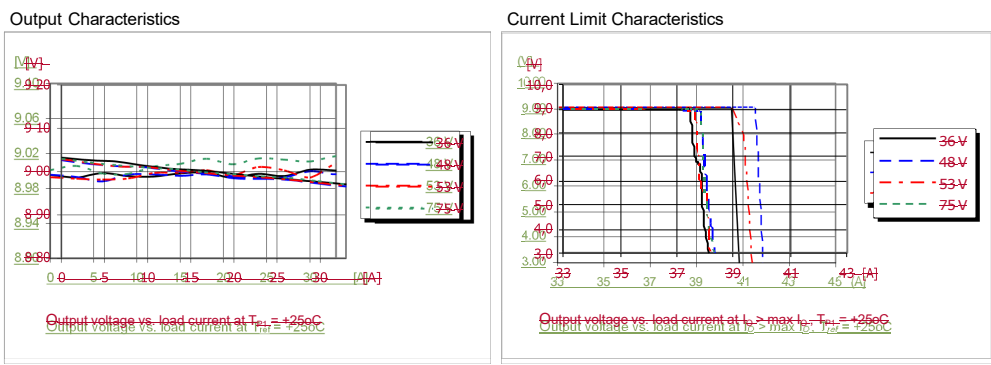
Thermal resistance vs. airspeed measured at the converter. Tested in wind tunnel with airflow and test conditions as per the Thermal consideration section. $V_L = 53$ V

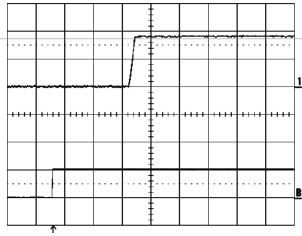
BMR 453	Ericsson Internal	EN/LZT 146 395 R1B September 2008
DC/DC Converters, Input 36-75 V, Output 33 A/400 W	© Ericsson AB	
PRODUCT SPECIFICATION		11 (19)
Prepared (also subject responsible if other):	No:	
EANDKUL	2/1301-BMR 453 Uen	
BMR 453 series	Checked	Date
DELTA B/GMF/EN/LZT 146 395 R3A July 2010	EN/LZT 146 395 R3A July 2010	
DC/DC Converters, Input 36-75 V, Output 33 A/400 W		
© Ericsson AB		

9.0V, 33A / 297W300W
Electrical Specification

BMR 453

0000xxxx/002





Start-up enabled by connecting V_i at:
 $T_{PL}, T_{off} = +25^{\circ}\text{C}$, $V_i = 53\text{ V}$,
 $I_o = 33\text{ A}$ resistive load.

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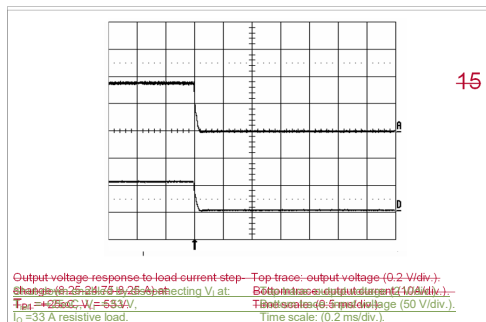
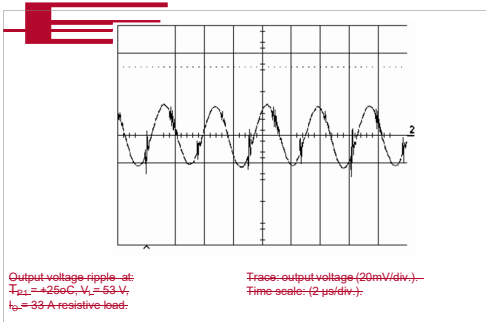
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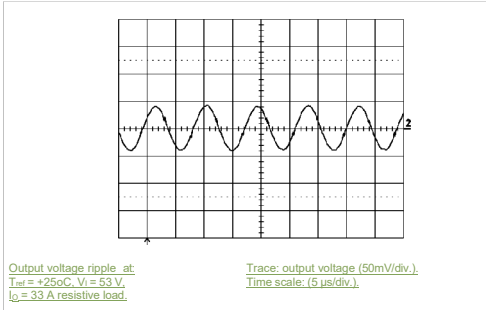
Shut-down enabled by disconnecting V_i at:

$T_{PL}, T_{off} = +25^{\circ}\text{C}$, $V_i = 53\text{ V}$,
 $I_o = 33\text{ A}$ resistive load.

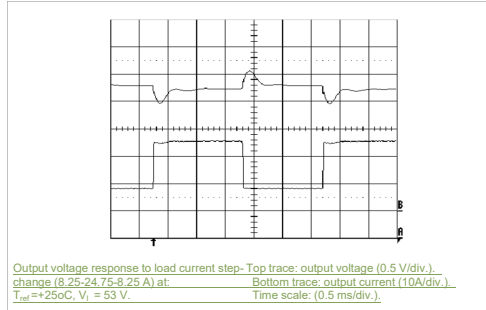
Top trace: output voltage (2 V/div).
Bottom trace: input voltage (50 V/div).
Time scale: (0.2 ms/div).



Output Ripple & Noise



Output Load Transient Response





Technical Specification 46

BMR 453
DC/DC Converters, Input 36-75 V, Output 33 A/400 W

EN/LZT 146 395 R1B September 2008
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Ericsson Internal

PRODUCT SPECIFICATION 123 (19)

Prepared (also subject responsible if other)

No.

EANDKUL 2/1301-BMR 453 Uen

BMR 453 series

Checked

Date

EN/LZT 146 395 R3A July 2010

DC/DC converters, Input 36-75 V, Output up to 33 A/400 W

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12.0V, 33A / 396W/400W Electrical Specification

BMR 453

0000xxxx/001

T_{ref} = -40 to +90°C, V_i = 36 to 75 V, sense pins connected to output pins unless otherwise specified under Conditions.

Typical values given at: T_{ref} = +25°C, V_i = 53 V, max I_o , unless otherwise specified under Conditions.

Additional C_{out} = 0.1 mF, Configuration File: 190 10-CDA 102 935/001 rev D3

Characteristics	Conditions	min	typ	max	Unit
V_i	Input voltage range	36		75	V
V_{off}	Turn-off input voltage	32	33	34	V
V_{on}	Turn-on input voltage	34	35	36	V
C_i	Internal input capacitance		18		μF
P_o	Output power	0		396	W
η	Efficiency	50 % of max I_o	96.5		%
		max I_o	95.5		
		50 % of max I_o , V_i = 48 V	96.5		
		max I_o , V_i = 48 V	95.5		
P_d	Power Dissipation	max I_o	18.3	27.1	W
P_i	Input idling power	I_o = 0 A, V_i = 53 V	2.4		W
P_{RC}	Input standby power	V_i = 53 V (turned off with RC)	190		mW
f_s	Default switching frequency	0-100 % of max I_o see Note 2	133	140	

Deleted Cells

Deleted Cells

V_{OL}	Output voltage initial setting and accuracy	T_{ref} = +25°C, V_i = 53 V, I_o = 17.33 A	11.88	12.0	12.12	V
V_o	Output adjust range	See operating information	8.1		13.25	V
	Output voltage tolerance band	0-100% of max I_o , see Note 1	11.76		12.24	V
	Line regulation	max I_o = 0 A, see Note 1	11.76	20	12.24	mV/V
	Load regulation	V_i = 53 V, 1-100% of max I_o , see Note 1		60.23	90.65	mV
V_r	Load transient voltage deviation	V_i = 53 V, Load step 25-75-25-1, 100% of max I_o , di/dt = 1 A/μs, see Note 3	±0.4		1.0	mV
t_{Vr}	Load transient recovery time	V_i = 53 V, Load step 25-75-25 % of max I_o , di/dt = 1 A/μs, C_o = 3.3mF, see Note 2		250	±0.4	μs
t_{Lr}	Ramp-up load transient recovery time (from 10-90 % of V_o)	10-100% of max I_o , T_{ref} = 25°C, V_i = 53 V, see Note 4		8250		ms
t_{L}	Start-up time (from V_i connection to 10-90 % of V_o)	10-100% of max I_o , T_{ref} = 25°C, V_i = 53 V	140			ms
t_{d}	Vin shutdown fall time (from V_i off connection to 10-90 % of V_o)	max I_o	0.4			ms
t_{f}	Vin shutdown fall time (from V_i off to 10% of V_o)	max I_o = 0 A				ms
t_{r}	RC start-up time	max I_o = 0 A		537		ms

Inserted Cells

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DELTA ELECTRONICS EX141026

Page 32

~~tr~~				
RC shutdown fail start-up time (from RC after 10% of V_O)	max I_O		3.233	ms
RC shutdown fail time (from RC after 10% of V_O)	max $I_O = 0\text{ A}$		73.2	ms
~~Io~~ Output current	$I_O = 0\text{ A}$		~~7~~	
~~IOL~~ Current limit threshold	$I_{OL} = 10.8\text{ V}$; $T_{OL} < \max(T_{OL})$	340	38	
~~Ilim~~ Short circuit current limit threshold	$T_{OL} = 25^\circ\text{C}$; see Note 5; $V_{OL} = 10.8\text{ V}$, $T_{OL} < \max(T_{OL})$	34	38	Deleted Cells
~~Coadj~~ Recommended Capacitive Load	$T_{OL} = 25^\circ\text{C}$, $V_{OL} < 0.2\text{ V}$, see Note 6.3		0.445	Inserted Cells
V_{Osc} Output ripple & noise	See ripple & noise section, max I_O ; see Note 4		6035	Deleted Cells
OVP Over voltage protection	$T_{OL} = 25^\circ\text{C}$, $V_I = 53\text{ V}$, 10-100% of max I_O ; see Note 7		15.6	Deleted Cells

Note 1: $V_{IN} = 40\text{ V}/-$
Note 2: Frequency may be adjusted with R_{ADJ} - see **Operating Information** section.
Note 3: $C_{ADJ} = 3\text{ nF}$ - see **Operating Information** section.
Note 4: Start up and Ramp up time can be increased via R_{ADJ} , see **Operating Information** section.
Note 5: OCP in both mode
Note 6: Low ESR value
Note 7: OVP level can be adjusted via R_{ADJ} , see **Operating Information**.



Technical Specification 47



Technical Specification 10

BMR 453-series

DC/DC converters, Input 36-75 V, Output 12 V, 33 A, 396/400 W

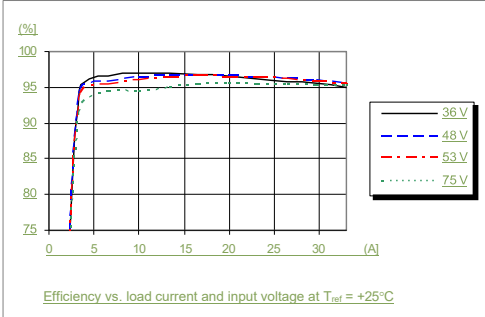
Prepared (also subject responsible if other) Ericsson Internal
Checked Date
EAB/JB/GMF (Natalie Johansson) (MICJMAL) 2010-06-30

PRODUCT SPECIFICATION
No. 21301-BMR 453-01
Rev. 1
Ericsson AB
Reference

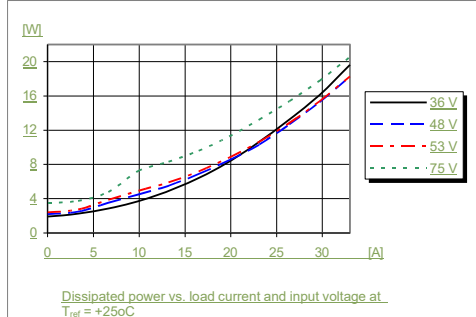
12.0V, 33A / 396W/400W Electrical Specification
0000xxx001

BMR 453

Efficiency



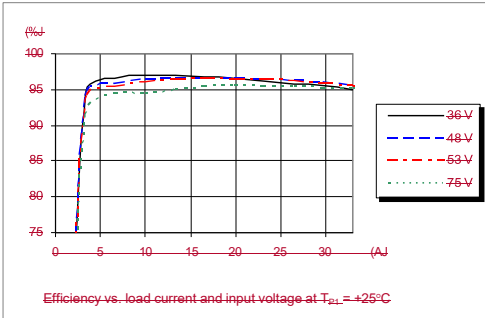
Power Dissipation



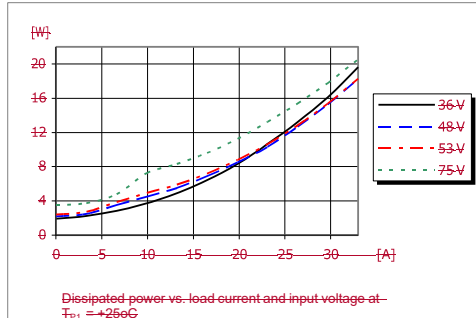
Output Current Derating, open frame

Output Current Derating, base plate option

Efficiency

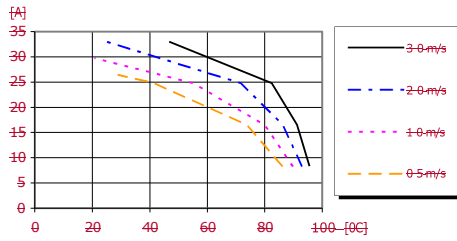


Power Dissipation

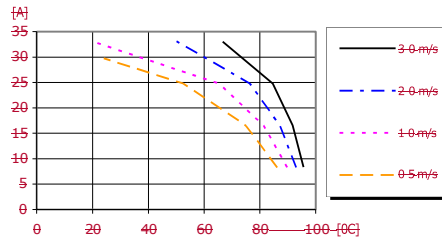


Output Current Derating, open frame

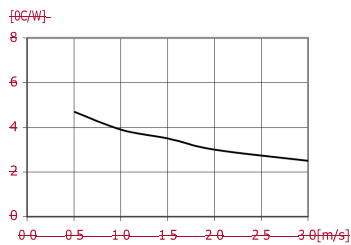
Output Current Derating, base plate option



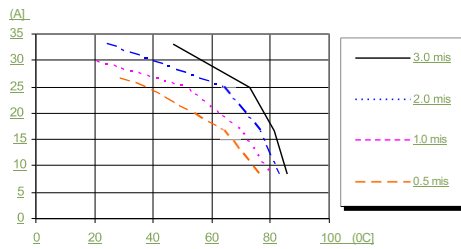
Available load current vs. ambient air temperature and airflow at $V_i = 53$ V. See Thermal Consideration section.



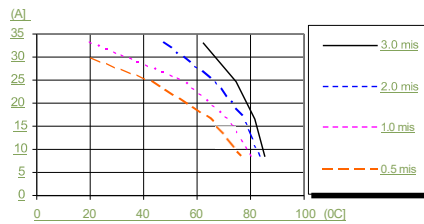
Available load current vs. ambient air temperature and airflow at $V_i = 53$ V. See Thermal Consideration section.



Thermal resistance vs. airspeed measured at the converter. Tested in wind tunnel with airflow and test conditions as per the Thermal consideration section. $V_i = 53$ V, $I_o = 25$ A

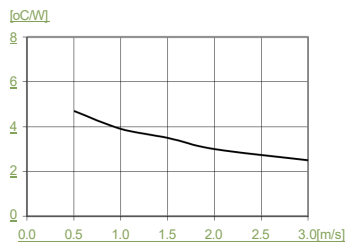


Available load current vs. ambient air temperature and airflow at $V_i = 53$ V. See Thermal Consideration section.



Available load current vs. ambient air temperature and airflow at $V_i = 53$ V. See Thermal Consideration section.

Thermal Resistance, base plate option



Thermal resistance vs. airspeed measured at the converter. Tested in wind tunnel with airflow and test conditions as per the Thermal consideration section. $V_i = 53$ V, $I_o = 25$ A

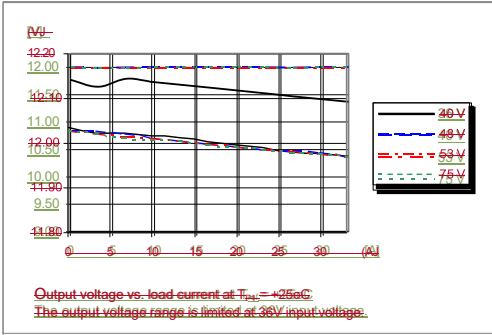


BMR 453	EN/LZT 146 395 R1B September 2008
DC/DC Converters, Input 36-75 V, Output 33 A/400 W	© Ericsson AB

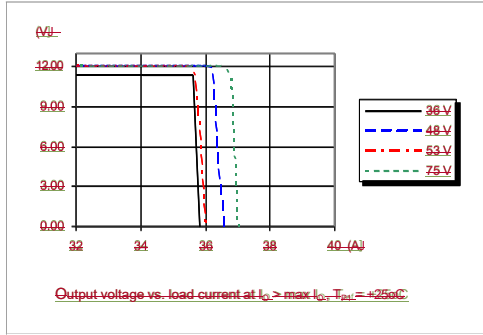
Ericsson Internal	
PRODUCT SPECIFICATION	
Prepared (also subject responsible if other)	No.
EANDKUL	2/1301-BMR 453 Uen
BMR 453 series	EN/LZT 146 395 R3A July 2010
DC/DC Converter, Input 36-75 V, Output 33 A/400 W	Reference
© Ericsson AB	

12.0V, 33A / 396W400W Electrical Specification BMR 453
0000xxx/001

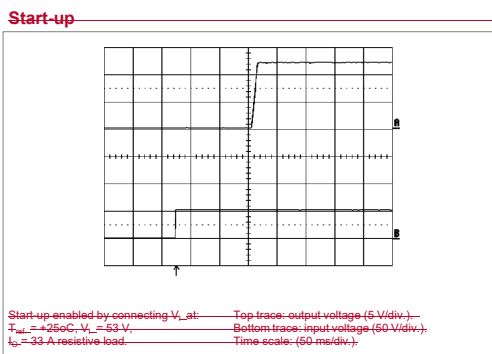
Output Characteristics



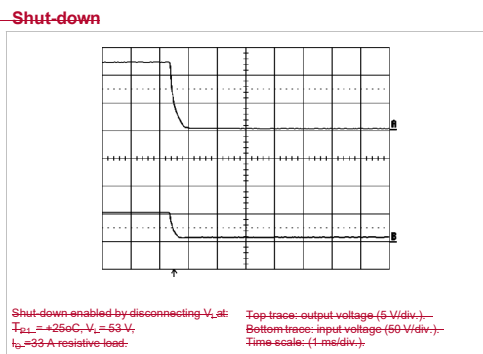
Current Limit Characteristics

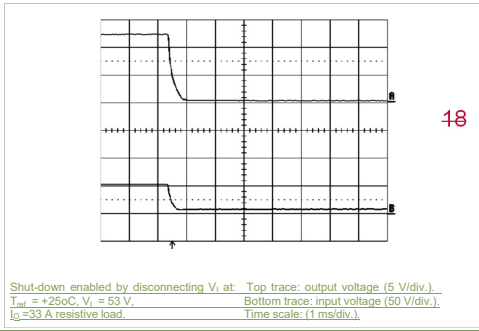
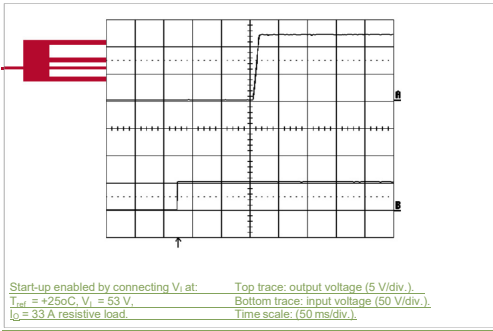


Start-up

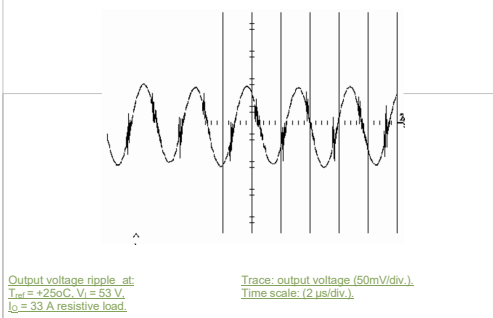


Shut-down

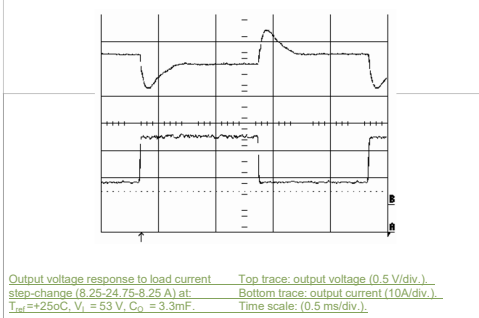




Output Ripple & Noise



Output Load Transient Response



BMP-453 series

DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

EN/LZT-146-396-R3A - July 2010





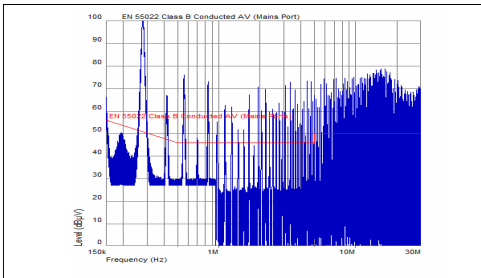
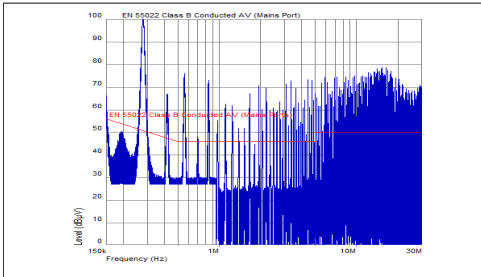
BMR 453
DC/DC Converters, Input 36-75 V, Output 33 A/400 W

EN/LZT 146.395 R1B September 2008
© Ericsson AB

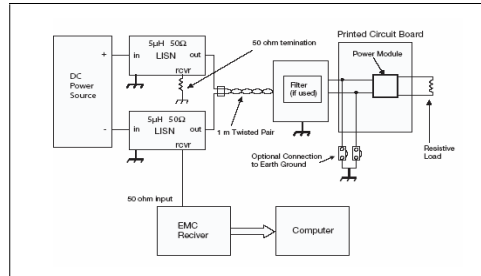
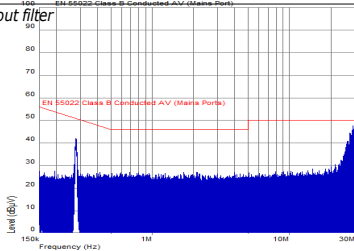
EMC Specification

Conducted EMI measured according to EN55022, CISPR 22 and FCC part 15J (see test set-up). See Design Note 009 for further information. The fundamental switching frequency is 140 kHz for BMR 453 @ $V_i = 53$ V, max I_{oLo} .

Conducted EMI Input terminal value (typ)



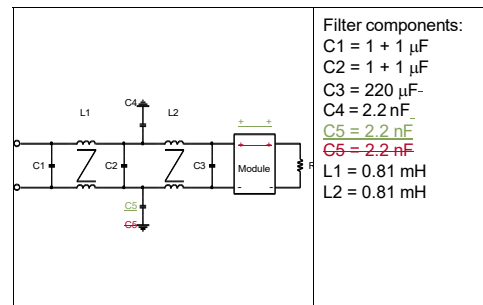
EMI without filter



Test set-up

External filter (class B)

Suggested external input filter in order to meet class B in EN 55022, CISPR 22 and FCC part 15J.



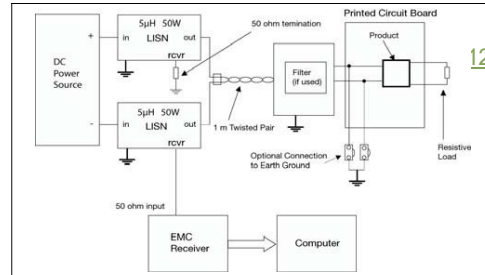
Filter components:
C1 = 1 + 1 μ F
C2 = 1 + 1 μ F
C3 = 220 μ F
C4 = 2.2 nF
C5 = 2.2 nF
L1 = 0.81 mH
L2 = 0.81 mH

EMI-with filter



Layout recommendation

The radiated EMI performance of the product DC/DC converter



converter will depend on the PWB PCB layout and ground layer design.

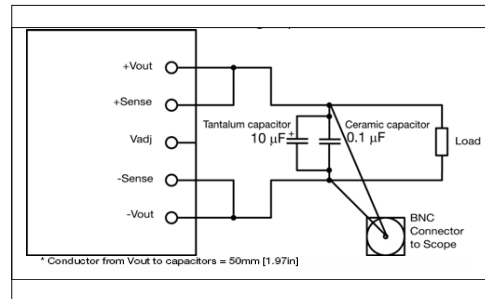
It is also important to consider the stand-off of the product DC/DC converter.

If a ground layer is used, it should be connected to one the output of the output terminals DC/DC converter and the equipment ground or chassis.

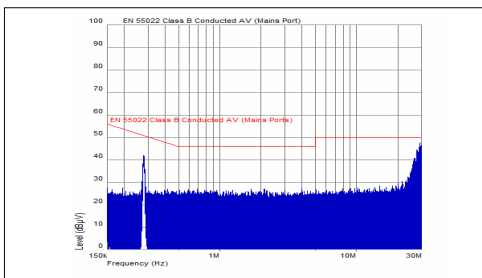
A ground layer will increase the stray capacitance in the PWB PCB and improve the high frequency EMC performance.

Output ripple and noise

Output ripple and noise measured according to figure below.
See Design Note 022 for detailed information.



Output ripple and noise test setup



EMI with filter

BMR 453- ~~series~~	EN/LZT 146 395 ~~R3A July 2010~~ <u>R1B September 2008</u>
DC/DC ~~converters~~ <u>Converters</u> , Input 36-75 V, Output ~~up to~~	© Ericsson AB
~~60~~ <u>33</u> A / ~~396~~ <u>400</u> W	



Technical Specification 20

Operating information

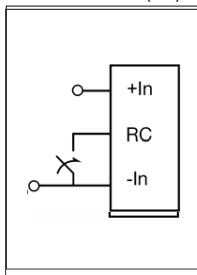
Input Voltage

The input voltage range 36 to 75 Vdc meets the requirements of the European Telecom Standard ETS 300 132-2 for normal input voltage range in -48 and -60 Vdc systems, -40.5 to -57.0 V and -50.0 to -72 V respectively. At input voltages exceeding 75 V, the power loss will be higher than at normal input voltage and T_{p4}, T_{ref} must be limited to absolute max $+125^{\circ}\text{C}$. The absolute maximum continuous input voltage is ~~80 Vdc~~ 80Vdc.

Turn-off Input Voltage

The ~~product monitors~~ DC/DC converters monitor the input voltage and will turn on and turn off at predetermined levels. The turn on and turn off level and the hysteresis in between can be configured via the PMBus. The default hysteresis between turn on and turn off input voltage is set to 2 V.

Remote Control (RC)



The products are fitted with a configurable remote control function. The primary remote control is referenced to the primary negative input connection (-In). The RC function allows the converter to be turned on/off by an external device like a semiconductor or mechanical switch. The RC pin has an internal pull up resistor. The remote control functions can also be configured using the PMBus.

The maximum required sink current is 1 mA. When the RC pin is left open, the voltage generated on the RC pin is max 6 V. The logic options for the primary remote control is configured using the PMBus. The default setting is negative logic ~~but positive logic option is available~~.

Remote Control (secondary side)

~~The CTRL-CS pin can be configured as remote control via the PMBus interface. In the default configuration the CTRL-CS pin is disabled and the output has an internal pull-up to 3.3 V. The CTRL-CS pin can be left open when not used. The logic options for the secondary remote control can be positive or negative logic.~~

Input and Output Impedance

The impedance of both the input source and the load will interact with the impedance of the ~~product~~ DC/DC converter. It is important that the input source has low characteristic impedance. ~~Minimum recommended external input capacitance is 100 μF .~~ The performance in some applications can be enhanced by addition of external capacitance as described under External Decoupling Capacitors. If the input voltage source contains significant inductance, the addition of a 100 μF capacitor across the input of the converter will ensure stable operation. The capacitor is not required when powering the DC/DC converter from an input source with an inductance below 10 μH .

External Decoupling Capacitors

When powering loads with significant dynamic current requirements, the voltage regulation at the point of load can be improved by addition of decoupling capacitors at the load. ~~The recommended minimum capacitance for the output is 13 μF .~~ Technical Specification

The most effective technique is to locate low ESR ceramic and electrolytic capacitors as close to the load as possible, using several parallel capacitors to lower the effective ESR. The ceramic capacitors will handle high-frequency dynamic load changes while the electrolytic capacitors are used to handle low frequency dynamic load changes. Ceramic capacitors will also reduce any high frequency noise ~~across~~at the load.

It is equally important to use low resistance and low inductance ~~PWB~~PCB layouts and cabling. External decoupling capacitors will become part of the control loop of the ~~product~~DC/DC converter and may affect the stability margins. As a "rule of thumb", 100 μ F/A of output current can be added without any additional analysis. The ESR of the capacitors is a very important parameter. Power Modules guarantee stable operation with a verified ESR value of >10 ~~m~~ Ω m Ω across the output connections. For further information please contact your local Ericsson Power Modules representative.

Parallel Operation

TBD. For further information please contact your local sales representative.

PMBus configuration and support

The ~~products~~BMR 453 DC/DC converters provide a PMBus digital interface that enables the user to configure many aspects of the device operation as well as monitor the input and output parameters. Please contact your local Ericsson Power Modules representative for appropriate SW tools to down-load new configurations.

Output Voltage Adjust using PMBus

The output voltage of the product can be reconfigured using the PMBus interface. ~~BMR 453-xx00/001 and /002~~The output voltage can be adjusted from ~~8.4V~~9V to 13.2V. ~~The BMR 453-xx02/003 and /004 can be adjusted from 3.0V to 6.7V.~~

Margin Up/Down Controls

These controls allow the output voltage to be momentarily adjusted, either up or down, by a nominal ~~40~~5%. This provides a convenient method for dynamically testing the operation of the load circuit over its supply margin or range. It can also be used to verify the function of supply voltage supervisors.

The margin up and down levels of the product can be re-configured using the PMBus interface.

BMR 453 series	EN/LZT 146-395-R3A July 2010
DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W	© Ericsson AB

Operating information-continued

Soft-start Power Up

The soft-start control introduces a time-delay (default setting 40 ms) before allowing the output voltage to rise. The default rise time of the ramp up is 10 ms. Power-up is hence completed within 50 ms in default configuration using remote control. When starting by applying input voltage the control circuit boot-up time adds an additional 100 ms delay. The soft-start power up of the product can be reconfigured using the PMBus interface.

Technical Specification 24

<u>BMR 453</u>	<u>EN/LZT 146.395 R1B September 2008</u>
<u>DC/DC Converters, Input 36-75 V, Output 33 A/400 W</u>	<u>© Ericsson AB</u>

EANDKUL

30/1301-BMR 453 Uen

Approved

Checked

Date

Rev

Reference

EAB/FJB/GKF (Natalie Johansson)

(MICJMAL)

2008-06-18

A

Operating information continuedRemote Sense

The products DC/DC converters have remote sense that can be used to compensate for voltage drops between the output and the point of load. The sense traces should be located close to the PCB ground layer to reduce noise susceptibility. The remote sense circuitry will compensate for up to 10% voltage drop between +Out pin/output pins and the point of load (+Sense). ~~—Sense pin should be connected to —Out and can not be used as remote sense.~~ If the remote sense is not needed +Sense should be connected to +Out, and -Sense should be connected to -Out. To be able to use remote sense the converter must be equipped with a digital connector.

Temperature Protection (OTP, UTP)

The products are protected from thermal overload by an internal temperature shutdown protection.

When $T_{p1}T_{ref}$ as defined in thermal consideration section is exceeded the product will shut down. The product will make continuous attempts to start up (non-latching mode) and resume normal operation automatically when the temperature has dropped below the temperature threshold, the hysteresis is defined in general electrical specification. The OTP and hysteresis of the product can be re-configured using the PMBus interface. The product has also an under temperature protection. The OTP and UTP fault limit and fault response can be configured via the PMBus. Note: using the fault response "continue without interruption" may cause permanent damage of the product.

Over Voltage Protection (OVP)

The product has output over voltage protection that will shut down the converter in over voltage conditions (latching mode) The OVP fault level and fault response can be re-configured using the PMBus interface.

Over Current Protection (OCP)

The product includes current limiting circuitry for protection at continuous overload. The product will ~~enter hic-up-mode~~ shut down if the maximum max output current (max Io) is exceeded and the output voltage is below 0.3×Vout 6V. The load distribution should be designed for the maximum output short circuit current specified. ~~If for some reason the output should be short circuited, minimum resistance should not be lower than 6mΩ.~~ The OCP level and fault response can be re-configured using the PMBus interface. ~~The default configuration is set to hic-up mode for~~ Note: using the fault response "continue without interruption" may cause permanent damage of the OCP, except for BMR453xxx/001 (latching OCP)-product.

Input Over/Under voltage protection

The input of the product can be protected against high input voltage and low input voltage. The over- and under-voltage fault level and fault response can be configured via the PMBus interface. Technical Specification 14

Pre-bias Start-up

The product has a Pre-bias start up functionality and will not sink current during start up if a pre-bias source is present at the output terminals.

Synchronization

When the PG SYNC pin is configured as an input (SYNC IN) the device will automatically check for a clock signal on the PG SYNC pin each time the module is enabled by RC or via PMBus. The incoming clock signal must be 100, 125, 140, 150, 200, 250 or 300kHz and must be stable when the module is enabled. The PG SYNC pin is configured via the PMBus interface.

Power Good

The PG SYNC pin can be configured as an output (POWER GOOD). The power good signal (TTL level) indicates proper operation of the product and can also be used as an error flag indicator. ~~The PG SYNC pin has POWER GOOD as default configuration with the output set as active low.~~ The PG SYNC pin is configured via the PMBus interface.

Tracking and External reference

The PG SYNC pin can be configured as an input for voltage tracking or an external analogue reference. The PG SYNC pin is configured via the PMBus interface ~~and has default setting Power Good.~~

Switching frequency adjust using PMBus

The switching frequency is set ~~to 140 kHz~~ to 140kHz as default but this can be reconfigured via the PMBus interface. The ~~product~~ converter is optimized at this frequency but can run at lower and higher frequency. ~~(125 kHz — 150 kHz).~~ However the output performance is not specified if the frequency is changed.

~~Input Transient~~

~~The BMR453 products have limited ability to react on sudden input voltage changes. As an example the 12V module BMR453xxx/001 can have an output voltage deviation of 5V when a 20V input step is applied (40V to 60V). This is tested with a slew rate of 0.1V/us on the input voltage change and minimum output capacitance 100uF. Increasing the output capacitance will improve the result.~~



Technical Specification 22

Product Name (if other)	No.	EN/LZT 146 395 R3A July 2010 R1B September 2008
Product No.	201101	BMR 453 Gen
Approved	Checked	Date
EAB/FJB/GMF (Natalie Johansson)	(MIC/JMAL)	2010-07-01
		© Ericsson AB
		Reference
		© Ericsson AB

Parallel Operation

Two BMR 453-xx00/xxx products can be directly connected in parallel for active current sharing. No external current sharing circuit are required. However both modules need to be pre-configured: one as a "master" the other one as a "slave". The recommended configuration parameters are presented in the table below.

The slave module will be synchronized with the master via the PG_SYNC pin and output current information will be sent to the slave via the CTRL_CS pin. Frequency Interleaving will be provided which will reduce the input line current ripple. The switching frequencies 125 kHz, 140 kHz and 150 kHz, may be used in order to support synchronisation during current share mode.

The same frequency should be selected on both paralleled products. The necessary electrical connections are showed in the figure. With a good PWB layout (equal trace resistances from each module to the connection point), the current sharing is very well balanced and both products are able to provide their full output current, i.e. the total maximum output current is $2 \times I_{Omax}$. **During start-up (i.e. until both master and slave unit reach the requested output voltage) the load current must be limited to 33 A and the master must start-up before the slave.** See table below for recommended master and slave configuration.

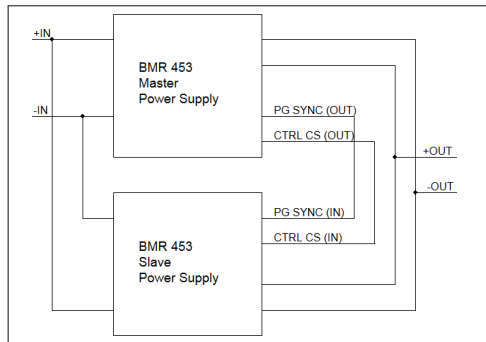
When two products are paralleled the output voltage may be limited depending on input voltage and load current. The graphs below show examples of the maximum available output voltage vs. input voltage and output current.

Synchronization with Frequency Interleaving

In order to reduce the input line current ripple, two products may be synchronized including frequency interleaving. Similarly as in the parallel configuration one module must be configured as a master, the other one as a slave. Only the sync signal should be provided from the master to the slave module. The same switching frequency restrictions as for the paralleling are valid. **When the PG_SYNC pin is configured as an input (SYNC-IN) the device will automatically check for a clock signal on the PG_SYNC pin each time the module is enabled by RG or via PMBus.**

Fault protection at parallel operation

During Master/Slave configuration the over-current protection is fixed to latching mode and this can not be reconfigured. If one of the two modules exceeds the OCP level, the module will turn off and both modules need a reset to be restarted. Both modules have internal over-temperature protection. However if the Master OTP is activated before the Slave, both modules need a reset.



Pin	Designation	Function
4	+IN	Positive input voltage
4	-IN	Negative input voltage
5	-OUT	Negative output voltage
42	PG-SYNC (IN) Slave	Sync signal (input)
42	PG-SYNC (OUT) Master	Sync signal (output)
45	CTRL-CS (IN) Slave	Current share signal (input)
45	CTRL-CS (OUT) Master	Current share signal (output)
46	+OUT	Positive output voltage

**BMR 453-series**

DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

EN/LZT-146-395-R3A July 2010

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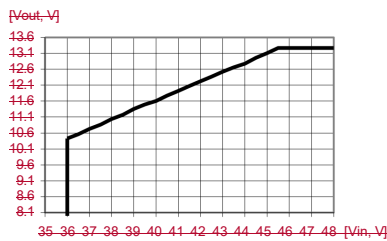
Master and slave configuration for current share mode at 12 V output voltage

Code	Command	Default setting Current-Share mode (Master)	Default setting Current-Share mode (Slave)	Comment
0xF9	MULTI_PIN_CONFIG	0xC0	0x60	Configure the multi-pin (Pin 12) for master and slave. Last bit can be 0 or 1.
0x60	TON_DELAY	0x0028 (40 ms)	0x0037 (55 ms)	The slave must have a 15 ms start-up delay compared to the master if the converters shall start-up with applied input voltage.
0x35	VIN_ON	0x002A (42 V) (For other output voltages see graph "Output voltage regulation")	0x002B (43 V) (For other output voltages see graph "Output voltage regulation")	1 V higher turn-on level for the slave. The slave regulation range is ± 1 V, from the initial start-up point.
0x33	FREQUENCY_SWITCH	0x008C (140 kHz)	0x008C (140 kHz)	It is important that the same frequency is set in both master and slave, to be able to sync master and slave.

Master and slave configuration for current share mode at 9 V output voltage

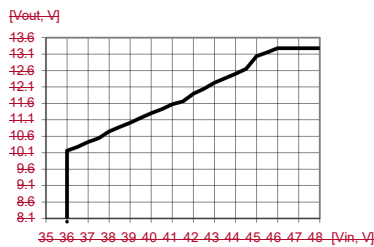
Code	Command	Default setting Current-Share mode (Master)	Default setting Current-Share mode (Slave)	Comment
0xF9	MULTI_PIN_CONFIG	0xC0	0x60	Configure the multi-pin (Pin 12) for master and slave. Last bit can be 0 or 1.
0x60	TON_DELAY	0x0028 (40 ms)	0x0037 (55 ms)	The slave must have a 15 ms start-up delay compared to the master if the converters shall start-up with applied input voltage.
0x35	VIN_ON	0x0024 (36 V) (For other output voltages see graph "Output voltage regulation")	0x0025 (37 V) (For other output voltages see graph "Output voltage regulation")	1 V higher turn-on level for the slave. The slave regulation range is ± 1 V, from the initial start-up point.
0x33	FREQUENCY_SWITCH	0x008C (140 kHz)	0x008C (140 kHz)	It is important that the same frequency is set in both master and slave, to be able to sync master and slave.

Output voltage regulation @ 33 A and 25°C



Output voltage regulation vs input voltage at: $T_{\text{a1}} = +25^\circ\text{C}$,
 $I_{\text{O}} = 33$ A resistive load. (Note 33 A is maximum load current at start-up)

Output voltage regulation @ 66 A and 25°C

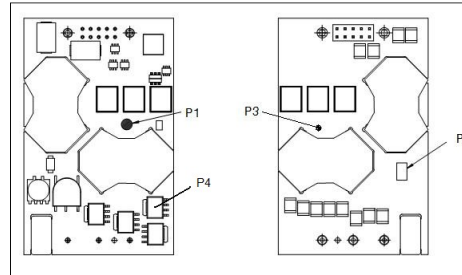


Output voltage regulation vs input voltage at: $T_{\text{a1}} = +25^\circ\text{C}$,
 $I_{\text{O}} = 66$ A resistive load. (Note 33 A is maximum load current at start-up)

Ericsson Internal
PRODUCT SPECIFICATION 6 (8)

Prepared (also subject responsible if other) No.
EANDKUL 30/1301-BMR 453 Uen

Approved	Checked	Date	Rev	Reference
EANDKUL (Natalie Johansson)	(MICJMAL)	2010-07-01	E	EN/LZT 146-395 R3A July 2010
BMR 453 series DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W			© Ericsson AB	



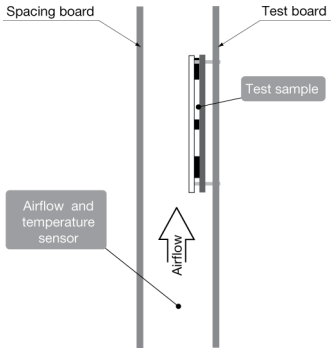
Prepared (also sub ect responsible if other)		No.	
EANDKUL		30/1301-BMR 453 Uen	
Approved	Checked	Date	Rev
EAB/FJB/GKF (Natalie Johansson)	(MICJMAL)	2008-06-18	A

Thermal Consideration

General

The ~~products~~converters are designed to operate in different thermal environments and sufficient cooling must be provided to ensure reliable operation. ~~For products mounted on a PWB without a heat sink attached, cooling~~ Cooling is achieved mainly by conduction, from the pins to the host board, and convection, which is dependant on the airflow across the ~~product~~converter. ~~Increased airflow enhances the cooling of the converter.~~ ~~Increased airflow enhances the cooling of the product.~~
The Output Current Derating graph found in the Output section for each model provides the available output current vs. ambient air temperature and air velocity at $V_{in} = 53\text{ V}$.
 $V_i = 53\text{ V}$.

The ~~product~~DC/DC converter is tested on a 254 x 254 mm,- 35 µm (1 oz), 8-layer test board mounted vertically in a wind tunnel with a cross-section of ~~608305~~ x ~~203305~~ mm.



Proper cooling
Definition of product operating temperature
The product operating temperatures is used to monitor the temperature of the product, and proper thermal conditionsDC/DC converter can be verified by measuring the temperature at positions~~position~~ P1, P2, P3, P4. The temperature at these positions (T_{P1} , T_{P2} , T_{P3} , T_{P4}) should not exceed the ~~maximum temperatures~~max values provided in the table below. ~~The number of measurement points may vary with different thermal design and topology.~~ Temperatures above maximum T_{P1} , measured at the reference point P1 (P3 for base plate versions) are not allowed and may cause permanent damage.

Note that the max value is the absolute maximum rating (non destruction) and that the electrical Output data is guaranteed up to $T_{ref} + 90^{\circ}\text{C}$.

See Design Note Q19 for further information.

Position	Device	Designation	max value
P ₁	Pcb	T_{ref}	125° C
P ₂	Opto-coupler	-	95° C

Top view

Bottom view

Thermal Consideration continued

Definition (Best airflow direction right to left.) – (base plate version)

Ambient Temperature Calculation

For products with base plate the maximum allowed ambient temperature can be calculated by using the thermal resistance:

of reference temperature (T_{ref})

1. The power loss is calculated by using the formula $((\frac{1}{\eta}) - 1) \times \text{output power} = \text{power losses (Pd)}$.

η = efficiency of product. E.g. 95% = 0.95

2. Find the thermal resistance (R_{th}) in the Thermal Resistance graph found in the Output section for each model. **Note that the thermal resistance can be significantly reduced if a heat sink is mounted on the top of the base plate.**

Calculate the reference temperature increase (ΔT):

$$\Delta T = R_{th} \times P_d$$

3. Max allowed ambient is used to monitor the temperature is:

$$\text{Max } T_{P1} = \Delta T$$

E.g. BMR 453-5100/001 at 2 m/s:

$$1. ((\frac{1}{0.944}) - 1) \times 396 \text{ W} = 23.5 \text{ W}$$

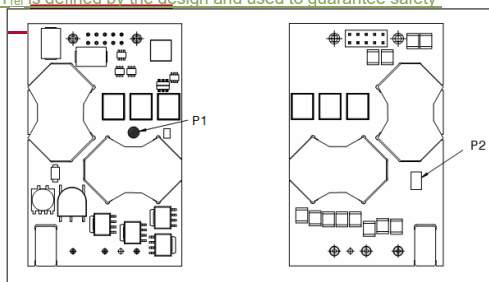
$$2. 23.5 \text{ W} \times 3.1^\circ\text{C/W} = 73^\circ\text{C}$$

3. $125^\circ\text{C} - 73^\circ\text{C} = \text{max ambient limits of the product.}$
Temperatures above maximum T_{ref} are not allowed and may cause degradation or permanent damage to the product. T_{ref} is also used to define the temperature is- 52°C range for normal operating conditions.

The actual temperature will be dependent on several factors such as the PWB size, number of layers and direction of airflow.

T_{ref} is defined by the design and used to guarantee safety

margins, proper operation and high reliability of the module.



Technical Specification 24



Position	Description	Max-let
BMR 453 DC/DC Converters, Input 36-75 V, Output 33 A/400 W	EN/LZT 146 395 R1B, September 2008	Deleted Cells
P1	PWB (reference point)	T ₂₁ =125° C
P2	Opto-coupler	T ₂₂ =105° C
P3	PWB (reference point for base-plate version)	T ₂₃ =125° C
P4	Primary MOSFET	T ₂₄ =125° C



BMR 453 series	EN/LZT-146-395-R3A - July 2010
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01301-BMR 453 Uen

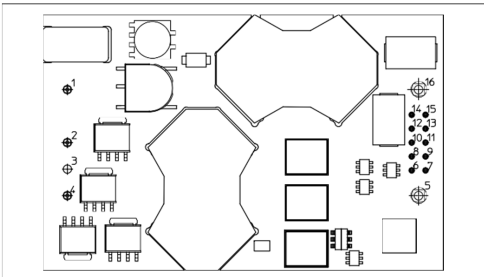
2008-06-18

Rev A

Reference

5 (6)

Connections (Top view)



Pin	Designation	Function
1	+In	Positive Input
2	RC	Remote Control
3	Case	Case to GND (optinal)
4	-In	Negative Input
5	-Out	Negative Output
6	S+	Positive Remote Sense
7	S-	Negative Remote Sense
8	SA0	Address pin 0
9	SA1	Address pin 1
10	SCL	PMBus Clock
11	SDA	PMBus Data
12	PG SYNC	Configurable I/O pin: Power Good output, SYNC-, tracking-, or ext ref-input
13	DGND	PMBus ground
14	SALERT	PMBus alert signal
15	CTRL CS	PMBus remote control- Current share
16	+Out	Positive Output



BMR 453-series DC/DC ~~converters~~ Converters , Input 36-75 V, Output ~~up to~~ ~~60~~ 33 A / ~~396~~ 400 W	EN/LZT 146 395 ~~R3A July 2010~~ R1B September 2008 © Ericsson AB
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31/1301-BMR 453

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Checked

Date

Rev

Reference

EAB/FJB/GMF (Natalie Johannson)

(MICJMAL)

2009-04-28

C

PMBus Communications

The products provide a PMBus digital interface that enables the user to configure many aspects of the device operation as well as monitor the input and output parameters. The products can be used with any standard two-wire I²C or SMBus host device. In addition, the device is compatible with PMBus version 1.1 and includes an SALERT line to help mitigate bandwidth limitations related to continuous fault monitoring.

Monitoring via PMBus

A system controller can monitor a wide variety of different parameters through the PMBus interface. The controller can monitor for fault condition by monitoring the SALERT pin, which will be asserted when any number of pre-configured fault or warning conditions occur. The system controller can also continuously monitor for any number of power conversion parameters including but not limited to the following:

- Input voltage
- Output voltage
- Output current
- Internal junction temperature
- Switching frequency
- Duty cycle

Evaluation software

A Configuration Monitoring and Management (CMM) evaluation software, is available for the products. For more information please contact your local Ericsson Power Modules sales representative.

Addressing

The figure and table below show recommended resistor values with min and max voltage range for hard wiring PMBus addresses (series E96, 1% tolerance resistors suggested):

PMBus Communications

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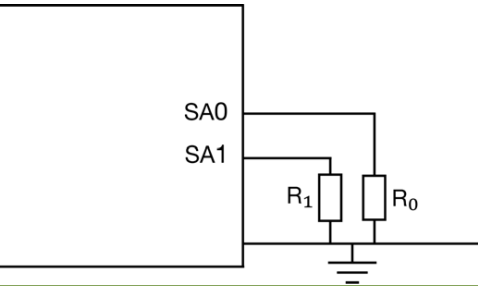
- Input voltage
- Output voltage
- Output current
- Internal junction temperature
- Switching frequency
- Duty cycle

Evaluation software

For the DC/DC converter Ericsson provides an evaluation software, CIVIVI. For more information please contact your local Ericsson sales representative.

Addressing

The figure and table below show recommended resistor values with min and max voltage range for hard-wiring PMBus addresses (series E96, 1% tolerance resistors suggested):



SA0/SA1	R ₁ /R ₀ [kΩ]	Min voltage[V]	Max voltage[V]
0	24.9	0.261	0.438
1	49.9	0.524	0.679
2	75	0.748	0.871
3	100	0.926	1.024
4	124	1.065	1.146
5	150	1.187	1.256
6	174	1.285	1.345
7	200	1.371	1.428

The SA0 and SA1 pins can be configured with a resistor to GND according to the following equation.

PMBus Address = 8 x (SA0value) + (SA1 value)

If any one of those voltage applied to ADC0 and ADC1 is out of the range from the table above, PMBus address 127 is assigned. If the calculated PMBus address is 0 or 12, PMBus address 127 is assigned instead. PMBus address 11 is not to be used. The user shall also be aware of further limitations of the addresses as stated in the PMBus Specification.



Ericsson Internal Technical Specification 27
PRODUCT SPECIFICATION 2 (4)

Prepared (also subject responsible if other)

No:

EANDKJL

31/1301-BMR 453

BMR 453 series

DC/DC converters, Input 36-75 V, Output up to 60/33 A / 396/400 W

Checked

Date

EN/LZT 146 395 R3A July 2010 R1B September

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Reference

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PMBus Commands

The DC/DC converter is PMBUS compliant. The following table lists the implemented PMBus commands. For more detailed information see PMBus Power System Management Protocol Specification; Part I — General Requirements, Transport and Electrical Interface and PMBus Power System Management Protocol; Part II — Command Language.

Designation	Cmd	Impl
Standard PMBus Commands		
Control Commands		
PAGE	00h	No
OPERATION	01h	Yes
ON_OFF_CONFIG	02h	Yes
WRITE_PROTECT	10h	Yes
Output Commands		
VOUT_MODE	20h	Yes
VOUT_COMMAND	21h	Yes
VOUT_TRIM	22h	Yes
VOUT_GAIN	23h	Yes
VOUT_MAX	24h	Yes
VOUT_MARGIN_HIGH	25h	Yes
VOUT_MARGIN_LOW	26h	Yes
VOUT_TRANSITION_RATE	27h	Yes
VOUT_DROOP	28h	No
VOUT_SCALE_LOOP	29h	Yes
VOUT_SCALE_MONITOR	2Ah	Yes
COEFFICIENTS	30h	No
POUT_MAX	31h	No
MAX_DUTY	32h	Yes
FREQUENCY_SWITCH	33h	Yes
VIN_ON	35h	Yes
VIN_OFF	36h	Yes
IOUT_CAL_GAIN	38h	Yes
IOUT_CAL_OFFSET	39h	Yes
Fault Limit Commands		
POWER_GOOD_ON	5Eh	Yes
POWER_GOOD_OFF	5Fh	Yes
VOUT_OV_FAULT_LIMIT	40h	Yes
VOUT_UV_FAULT_LIMIT	44h	Yes
IOUT_OC_FAULT_LIMIT	46h	Yes
IOUT_OC_LV_FAULT_LIMIT	48h	Yes
IOUT_UC_FAULT_LIMIT	4Bh	No

Designation	Cmd	Impl
OT_WARN_LIMIT	51h 51h	Yes Yes
UT_WARN_LIMIT	52h 52h	Yes Yes
UT_FAULT_LIMIT	53h 53h	Yes Yes
VIN_OV_FAULT_LIMIT	55h 55h	Yes Yes
VIN_OV_WARN_LIMIT	57h 57h	Yes Yes
VIN_UV_WARN_LIMIT	58h 58h	Yes Yes
VIN_UV_FAULT_LIMIT	59h 59h	Yes Yes
VOUT_OV_WARN_LIMIT	42h 42h	Yes Yes
VOUT_UV_WARN_LIMIT	43h 43h	Yes Yes
IOUT_OC_WARN_LIMIT	44h 44h	Yes Yes
IIN_OC_FAULT_LIMIT	5Bh 5Bh	No No
IIN_OC_WARN_LIMIT	5Dh 5Dh	No No
Fault Response Commands		
VOUT_OV_FAULT_RESPONSE	41h 41h	Yes Yes
VOUT_UV_FAULT_RESPONSE	45h 45h	Yes Yes
OT_FAULT_RESPONSE	50h 50h	Yes Yes
UT_FAULT_RESPONSE	54h 54h	Yes Yes
VIN_OV_FAULT_RESPONSE	56h 56h	Yes Yes
VIN_UV_FAULT_RESPONSE	5Ah 5Ah	Yes Yes
IOUT_OC_FAULT_RESPONSE	47h 47h	Yes Yes
IOUT_UC_FAULT_RESPONSE	4Ch 4Ch	No No
IIN_OC_FAULT_RESPONSE	5Ch 5Ch	No No
Timing Commands		
TON_DELAY	60h 60h	Yes Yes
TON_RISE	61h 61h	Yes Yes
TON_MAX_FAULT_LIMIT	62h 62h	Yes Yes
TON_MAX_FAULT_RESPONSE	63h 63h	Yes Yes
TOFF_DELAY	64h 64h	Yes Yes
TOFF_FALL	65h 65h	Yes Yes
TOFF_MAX_WARN_LIMIT	66h 66h	Yes Yes
Status Commands (Read Only)		
CLEAR_FAULTS	03h 03h	Yes Yes
STATUS_BYTES	78h 78h	Yes Yes
STATUS_WORD	79h 79h	Yes Yes
STATUS_VOUT	7Ah 7Ah	Yes Yes
STATUS_IOUT	7Bh 7Bh	Yes Yes
STATUS_INPUT	7Ch 7Ch	Yes Yes
STATUS_TEMPERATURE	7Dh 7Dh	Yes Yes
STATUS_CML	7Eh 7Eh	Yes Yes
STATUS_OTHER	7Fh 7Fh	Yes Yes
Monitor Commands (Read Only)		
READ_VIN		

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OT_FAULT_LIMIT	4Fh	Yes
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BMR 453-series
DC/DC converters, Input 36-75 V, Output ~~up to~~
~~60~~33 A / ~~396~~400 W

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2008
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Designation	Cmd	Impl
READ_IOUT	8Bh 8Ch	Yes Yes
READ_TEMPERATURE_1	8Ch 8Dh	Yes Yes
READ_TEMPERATURE_2	8Dh 8Eh	Yes Yes
READ_TEMPERATURE_2	8Eh 90h	Yes No
READ_FAN_SPEED_1	90h 94h	No Yes
READ_FAN_SPEED_2	94h 95h	Yes Yes
READ_FREQUENCY	95h 96h	Yes No
READ_IOUT	96h 97h	No No
READ_PIN Commands (Read Only)	97h	No
Identification Commands (Read Only)	98h 99h	Yes
MFR_REVISION	98h 99h	Yes Yes
MFR_MODEL	99h 9Ah	Yes Yes
MFR_REVISION	9Ah 9Bh	Yes Yes
MFR_REVISION	9Bh 9Ch	Yes Yes
MFR_LOCATION	9Ch 9Dh	Yes Yes
MFR_DATE	9Dh 9Eh	Yes Yes
MFR_SERIALS	9Eh	Yes
INTERLEAVE Commands	37h	No
INTERLEAVE Commands	37h	No
Supervisory Commands	11h	Yes
STORE_DEFAULT_ALL	41h 42h	Yes Yes
RESTORE_DEFAULT_ALL	42h 43h	Yes Yes
STORE_USER_ALL	43h 44h	Yes Yes
RESTORE_USER_ALL	44h	Yes
BMR 453 Specific Commands	D0h	Yes
MFR_POWER_GOOD_POLARITY	D0h D2h	Yes Yes
MFR_VIN_SCALE_MONITOR	D2h D3h	Yes Yes
MFR_VIN_SCALE_MONITOR	D3h D4h	Yes Yes
MFR_VIN_SCALE_MONITOR	D4h D5h	Yes Yes
MFR_VIN_SCALE_MONITOR	D5h D6h	Yes Yes
MFR_ACTIVE_COEFF_CIA_TABLE	D6h D8h	Yes Yes
MFR_ACTIVE_COEFF_CIA_TABLE	D8h DCh	Yes Yes
MFR_SELECT_TEMP_SENSOR	DCD Dh	Yes Yes
MFR_VIN_OFFSET	DDh E2h	Yes Yes
MFR_REMOTE_TEMP_CAL	E2h E3h	Yes Yes
MFR_REMOTE_TEMP_CAL	E3h E4h	Yes Yes
MFR_DEAD_BAND_MODE	E4h E5h	Yes Yes
MFR_DEAD_BAND_DELAY	E5h E7h	Yes Yes
MFR_TEMP_COEFF_SCALE	E7h E8h	Yes Yes
MFR_VOUT_ANALOG_SCALE_REF	E8h E9h	Yes Yes
MFR_READ_VOUT_ANALOG_REF	E9h F0h	Yes Yes
MFR_DEBUG_BUFF	F0h	Yes

Designation	Cmd	Impl
MFR_SETUP_PASSWORD	F1h	Yes
MFR_DISABLE_SECURITY	F2h	Yes
MFR_DEAD_BAND_IOUT_THRESHOLD	F3h	Yes
MFR_SECURITY_BIT_MASK	F4h	Yes
MFR_PRIMARY_TURN	F5h	Yes
MFR_SECONDARY_TURN	F6h	Yes
MFR_SET_DPWM_POLARITY	F7h	Yes
MFR_ILIM_SOFTSTART	F8h	Yes
MFR_MULTI_PIN_CONFIG	F9h	Yes
MFR_DEAD_BAND_VIN_THRESHOLD	FAh	Yes
MFR_DEAD_BAND_VIN_IOUT_HYS	FBh	Yes
MFR_FIRMWARE_VERSION	FC	Yes
MFR_MESSAGE_CODE_DEVICE_ID	FDh	Yes

Notes:
Cmd is short for Command.
Impl is short for Implemented.



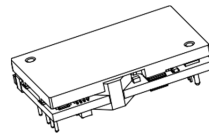
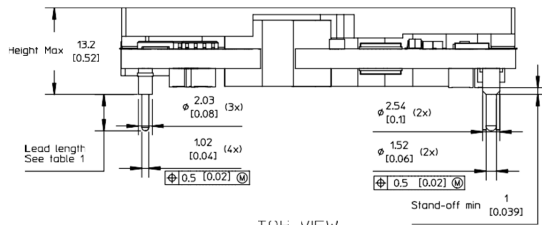
BMR 453 series

DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

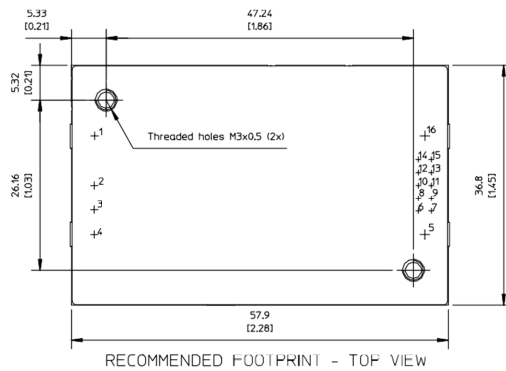
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Mechanical Information - Through Hole Mount, Base Plate Version



TOP VIEW
Pin positions according to
recommended footprint



RECOMMENDED FOOTPRINT - TOP VIEW

X1	Lead_length
0	5.33 [0.210]
2	3.68 [0.145] (cut)
3	4.57 [0.180] (cut)
4	2.79 [0.110] (cut)
5	2.79 [0.110]

CASE

Material: Aluminium

For screw attachment apply mounting torque of max 0.44 Nm [3.9 lbf in]. M3 screws must not protrude more than 2.7 mm [0.106] in to the base plate.

PIN SPECIFICATIONS

Pin 1,2,3,4,5 & 16 Material: Copper Alloy

Plating: Min Au 0.3µm over 1-3µm Ni.

Pin 6-15 Material: Brass

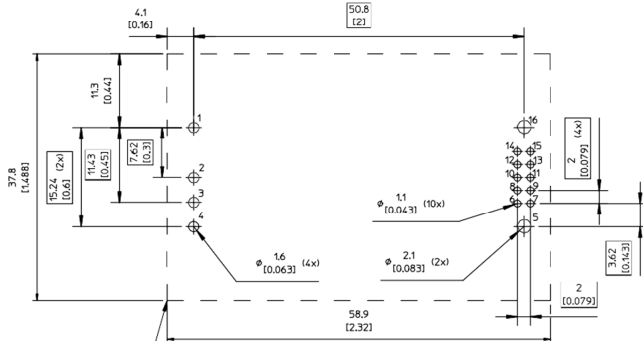
Plating: Min Au 0.2µm over 1.3µm Ni.

NOTE

Pin 6-15 are optional and only used if digital communication is requested.

Pin 3 is only used for baseplate GND connection.

X1-5 Are special customer pins with extra stand off 6.7 mm & Max height 18.9 mm.



Recommended keep away area for user components.

The stand-off in combination with insulating material ensures that requirements as per IEC/EN/UL60950 are met and 1500 V isolation maintained even if open vias or traces are present under the DC/DC converter.

Weight: Typical 67 g

All dimensions in mm [inch].

Tolerances unless specified:

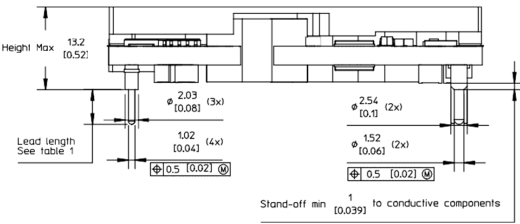
x.xx +0.50 [0.02], x.xx+0.25 [0.01]

(not applied on footprint or typical values)

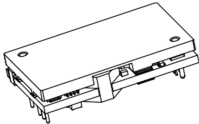




BMR 453 DC/DC Converters, Input 36-75 V, Output 33 A/400 W	EN/LZT 146.395 R1B, September 2008 © Ericsson AB
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TOP VIEW



14	Lead length
9	0.00-0.000
2	0.00-0.000
3	0.00-0.000
4	0.00-0.000
5	0.00-0.000

All component placements—whether shown as physical components or symbolical outline—are for reference only and are subject to change throughout the product's life cycle, unless explicitly described and dimensioned in this drawing.

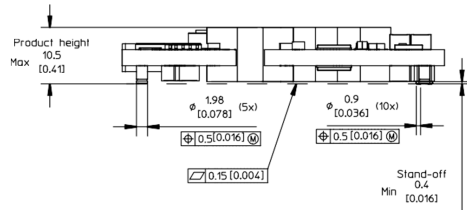


BMR 453 series
DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

EN/LZT 146-395-R3A-July 2010

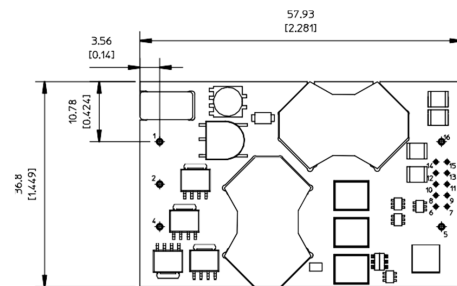
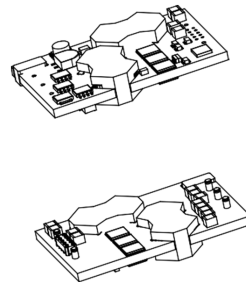
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Mechanical Information - SMD mount, Open Frame Version

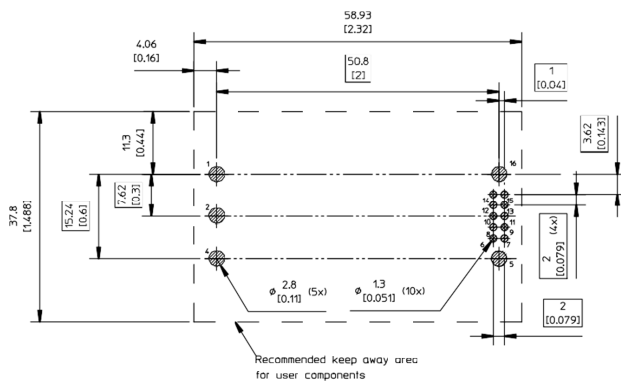


TOP VIEW

Pin positions according to recommended footprint



RECOMMENDED FOOTPRINT - TOP VIEW



NOTES

PIN SPECIFICATIONS
Pin 1,2,4,5 & 16 - Material: Copper alloy
Plating: Au 0.1 μ m over 1-3 μ m Ni.
Pin 6-15 - Material: Brass
Plating: Au 0.1 μ m over 2 μ m Ni.

Weight: Typical 46 g

All dimensions in mm (inch).
Tolerances unless specified:
x.x $\pm$ 0.5 mm [0.02]
x.xx $\pm$ 0.25 mm [0.01]
Not applied on footprint or typical values!



All component placements—whether shown as physical components or symbolical outline—are for reference only and are subject to change throughout the product's life cycle, unless explicitly described and dimensioned in this drawing.

**BMR 453 series**

DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W

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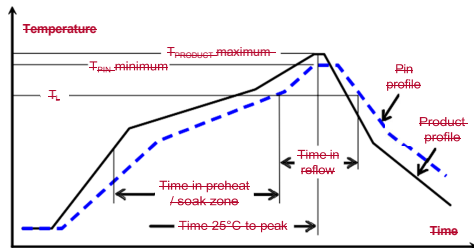
Soldering Information – Surface Mounting

The surface mount product is intended for forced convection or vapor phase reflow soldering in SnPb and Pb-free processes.

The reflow profile should be optimised to avoid excessive heating of the product. It is recommended to have a sufficiently extended preheat time to ensure an even temperature across the host PWB and it is also recommended to minimize the time in reflow.

A no-clean flux is recommended to avoid entrapment of cleaning fluids in cavities inside the product or between the product and the host board, since cleaning residues may affect long-time reliability and isolation voltage.

General reflow process specifications		SnPb-eutectic	Pb-free
Average ramp-up (T_{PRODUCT})		3°C/s-max	3°C/s-max
Typical solder-melting (liquidus)-temperature	T_L	183°C	221°C
Minimum reflow time above T_L		30 s	30 s
Minimum pin temperature	T_{PIN}	240°C	235°C
Peak product temperature	T_{PRODUCT}	225°C	260°C
Average ramp-down (T_{PRODUCT})		6°C/s-max	6°C/s-max
Maximum time 25°C to peak		6-minutes	8-minutes

**Minimum Pin Temperature Recommendations**

Pin number 5 chosen as reference location for the minimum pin temperature recommendation since this will likely be the coolest solder joint during the reflow process.

SnPb solder processes

For SnPb solder processes, a pin temperature (T_{PIN}) in excess of the solder melting temperature, (T_L , 183°C for Sn63Pb37) for more than 30 seconds and a peak temperature of 240°C is recommended to ensure a reliable solder joint.

For dry packed products only: depending on the type of solder paste and flux system used on the host board, up to a recommended maximum temperature of 245°C could be used, if the products are kept in a controlled environment (dry pack handling and storage) prior to assembly.

Lead-free (Pb-free) solder processes

For Pb-free solder processes, a pin temperature (T_{PIN}) in excess of the solder melting temperature (T_L , 217 to 221°C for SnAgCu solder alloys) for more than 30 seconds and a peak temperature of 235°C on all solder joints is recommended to ensure a reliable solder joint.

Maximum Product Temperature Requirements

Top of the product PWB near pin 2 is chosen as reference location for the maximum (peak) allowed product temperature (T_{PRODUCT}) since this will likely be the warmest part of the product during the reflow process.

SnPb solder processes

For SnPb solder processes, the product is qualified for MSL-1 according to IPC/JEDEC standard J-STD-020G.

During reflow T_{PRODUCT} must not exceed 225 °C at any time.

Pb-free solder processes

For Pb-free solder processes, the product is qualified for MSL-3 according to IPC/JEDEC standard J-STD-020G.

During reflow T_{PRODUCT} must not exceed 260 °C at any time.

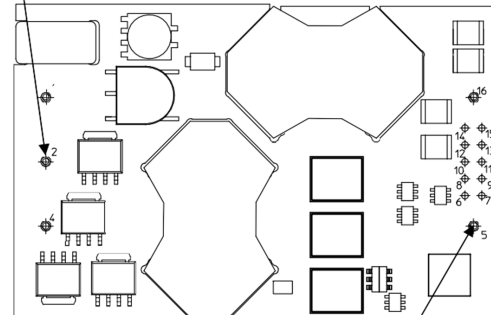
Dry Pack Information

Products intended for Pb-free reflow soldering processes are delivered in standard moisture barrier bags according to IPC/JEDEC standard J-STD-033 (Handling, packing, shipping and use of moisture/reflow sensitivity surface mount devices).

Using products in high temperature Pb-free soldering processes requires dry pack storage and handling. In case the products have been stored in an uncontrolled environment and no longer can be considered dry, the modules must be baked according to J-STD-033.

Thermocoupler Attachment

Pin 2 for measurement of maximum product temperature T_{PRODUCT}



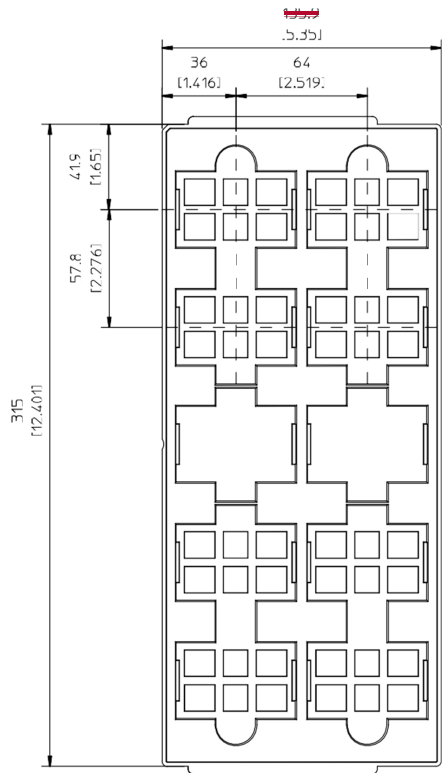
Pin 5 for measurement of minimum pin (solder joint) temperature T_{PIN}



BMR 453 series	EN/LZT 146-395-R3A-July 2010
DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W	© Ericsson-AB

Delivery Package Information – Surface Mount Version
The products are delivered in antistatic injection molded trays- (Jedec design-guide 4.10D-standard):

Tray-Specifications	
Material	Antistatic PPE
Surface resistance	$10^5 < \text{Ohm/square} < 10^{12}$
Bakability	The trays can be baked at maximum- 125°C for 48 hours
Tray thickness	14.50 mm - 0.571 [inch]
Box capacity	20 products - (2- full trays/box)
Tray weight	125 g empty, 574 g full-tray



JEDEC standard tray for 2x5 = 10 products-
All dimensions in mm [inch]
Tolerances: X.x ±0.26 [0.01], X.xx ±0.13 [0.005]

Note:- pick up positions refer to center of pocket.
See mechanical drawing for exact location on product.



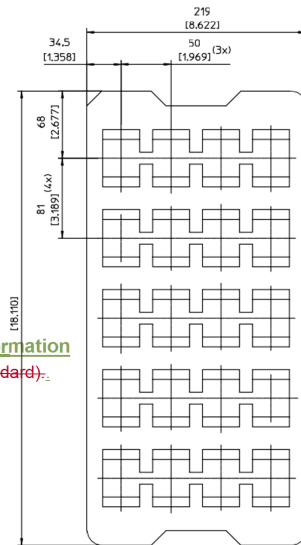
BMR 453 series	EN/LZT 146-395-R3A July 2010
DC/DC converters, Input 36-75 V, Output up to 60 A / 396 W	© Ericsson AB

Soldering Information — Hole Mounting

The hole mounted product is intended for plated through hole mounting by wave or manual soldering. The pin temperature is specified to maximum to 270°C for maximum 10 seconds.

A maximum preheat rate of 4°C/s and maximum preheat temperature of 150°C is suggested. When soldering by hand, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

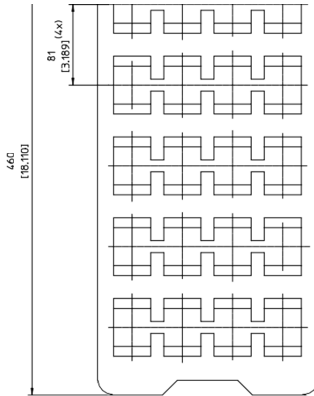
A no-clean flux is recommended to avoid entrapment of cleaning fluids in cavities inside the product or between the product and the host board. The cleaning residues may affect long time reliability and isolation voltage.



Delivery Package Information — Hole Mount version package information

The products are delivered in antistatic trays (Jedec design guide 4-10D standard).

Tray Specifications	
Material	PE Foam, dissipative
Surface resistance	$10^5 < \Omega \text{m} < 10^{12} \text{ ohms/square} < 10^{12}$
Bakability	The trays are not bakable.
Tray capacity	20 converters/tray
Box capacity	20 products (2 full trays/box) 20 converters
Tray weight/Weight	Product — Open frame 1100 g full tray, 140 g empty tray Product — Base plate option 1480 g full tray, 140 g empty tray



Prepared (also subject responsible if other)

Ne

BMR 453 ~~EPETSCH~~
Approved

~~5/1301-BMR-453 Uer~~
~~EN/ ZT 146 395~~

Date	Rev	Reference
2008		

DC/DC converters, Input 36-75 V, Output up to 10.0621
60/33 A / 396/400 W See 5/1301-BMR 453 Gen

Approved	Checked	Date	Rev
EAB/FJB/GKF [Natalie J]	See § 1	2008-04-29	A

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Product Qualification Specification

Characteristics			
External visual inspection	IPC-A-610		
Change of temperature (Temperature cycling)	IEC 60068-2-14 Na	Temperature range Number of cycles Dwell/transfer time	-40 to 100°C 1000 15 min/0-1 min
Cold (in operation)	IEC 60068-2-1 Ad	Temperature T _A Duration	-45°C 72 h
Damp heat	IEC 60068-2-67 Cy	Temperature Humidity Duration	85°C 85 % RH 1000 hours
Dry heat	IEC 60068-2-2 Bd	Temperature Duration	125°C 1000 h
Electrostatic discharge susceptibility	IEC 61340-3-1, JESD 22-A114 IEC 61340-3-2, JESD 22-A115	Human body model (HBM) Machine Model (MM)	Class 2, 2000 V Class 3, 200 V
Immersion in cleaning solvents	IEC 60068-2-45 XA, method 2	Water Glycol ether Isopropyl alcohol	55°C 35°C (35°C)
Mechanical shock	IEC 60068-2-27 Ea	Peak acceleration Duration	100 g 6 ms
Moisture reflow sensitivity ¹	J-STD-020C	Level 1 (SnPb-eutectic) Level 3 (Pb Free)	225°C 260°C
Operational life test	MIL-STD-202G, method 108A	Duration	1000 h
Resistance to soldering heat ²	IEC 60068-2-20 Tb, method 1A	Solder temperature Duration	270°C 10-13 s
Robustness of terminations	IEC 60068-2-21 Test Ua1 IEC 60068-2-21 Test Ue1	Through hole mount products Surface mount products	All leads All leads
Solderability	IEC 60068-2-58 test Td ¹	Preconditioning Temperature, SnPb Eutectic Temperature, Pb-free	150°C dry bake 16 h 215°C 235°C
	IEC 60068-2-20 test Ta ²	Preconditioning Temperature, SnPb Eutectic Temperature, Pb-free	Steam ageing 235°C 245°C
Vibration, broad band random	IEC 60068-2-64 Fh, method 1	Frequency Spectral density Duration	10 to 500 Hz 0.07 g ² /Hz 10 min in each direction

Notes

¹ Only for products intended for reflow soldering (surface mount products)² Only for products intended for wave soldering (plated through hole products)